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# Lighting in Coal Mines

IT is safe to say that in no large industry do the workers have to put up with so poor a standard of illumination as that usually found at the coal face. This condition has resulted in accidents and loss of output just as it has in factories in which lighting is inadequate, but, in addition, it is largely responsible for the eye trouble known as nystagmus, for which some £500,000 is annually paid in compensation to sufferers—that is if any money payment can be regarded as compensation.

Although considerable improvement has been brought about during late years, as Professor W. M. Thornton states in his review of "Electricity in Mining" in the *Journal* of the I.E.E., and the Mines Department in 1934 prescribed minimum candle-powers, the illumination practicable in the circumstances is by ordinary comparisons usually bad. Prevailing values of illumination are, of course, far below the figures obtaining in factories, and what is regarded as a "good" allowance of foot candles at the coal seam may be less than a tenth of that thought necessary for the performance of even rough work in an industrial establishment.

Although there are notable exceptions, it would seem from available data that the poor lighting which at present is all that can usually be given to the hewer for his work influences ideas regarding luminous intensities required in other parts of the colliery where the same difficulties are not encountered. In an article included in this issue Mr. J. W. Howell gives some data regarding intensities that should prove satisfactory in practice and refers to the employment of the peculiar properties of the light from discharge-lamps to facilitate coal picking.

Reverting to conditions at the coal face, for the mitigations that recent years have brought thanks are due to the battery lamp, which forms a rapidly increasing proportion of the total, nearly 400,000 now being in use. Further improvement may still be expected, as less than 10 per cent. of these are cap lamps, which have better light-giving potentialities. The use of the latter is curiously localised and they seem to have met with little favour in South Wales, for instance; their chief drawback is on account of the weight of the battery, which is strapped to the hewer's back. Another recent development of interest is the compressed-air turbine lamp, which is said to give greatly increased illumination combined with safety.

Nevertheless, in spite of the advances that have been, and will, no doubt, still be, made in methods of employing portable lamps, including those of the semi-portable type to provide general illumination at certain points and the helpful spraying of whitewash, where this is possible, for increasing reflection, this system cannot be expected to give results that would be considered satisfactory elsewhere.

There is a need for the development of a system of mains lighting that could be extended to the coal face. This is permissible only in exceptional cases at present, and indeed there are inherent difficulties that often make it appear impracticable to the mine manager. The obstacles to mains lighting, in addition to the usual flame-proof requirements, are the frequent moving of the coal-face, the confined space for operation, the need to protect apparatus from damage by shot-firing or by falls of roof, and the obscuring of the light by timber supports or the hewer's own body. Then the light available is minimised by the poor reflective surface provided by coal.

The most suitable voltage is another item for consideration. The highest allowed is 125 V, but some advocate a figure as low as 25, in view of the peculiar conditions obtaining, but against this must be set the greater rapidity with which the lamp filaments are chilled at higher voltages, which reduces the risk of explosion in gaseous atmospheres.

The outlook does not appear too promising, but is it worse than some others that have from time to time faced electrical men and have given them opportunities of achieving the "impossible"?

**The Cost of Comfort**

How many people have ever estimated the cost of using a coal fire? A homely experiment can easily be made by noting the weight and cost of coal consumed in a given time in a room of known cubic content to produce and maintain a rise of temperature above that of the outside air that is usually found to be tolerable. The cost of equalling the same conditions with electricity at ordinary prices will probably be found to be surprisingly low. The reason is that without electricity we accept a standard of comfort far below that which electricity can provide. Under identical conditions the electrical method, as Major R. W. Klitz shows on a later page, may be much cheaper. If the cost proves, in use, to be higher, it is often because a greater degree of comfort has been enjoyed, not because electricity itself is more expensive.

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**A.C. Calculations**

WHILE elementary a.c. circuit problems can usually be solved without the use of complex quantities, the symbolic notation for vectors considerably simplifies this class of calculation. Non-mathematical engineers, however, find a real difficulty in identifying the unit vector with the square root of minus one (a number that algebra textbooks long designated impossible), and hence adopt a sceptical attitude towards symbolic notation, which they regard as artificial, so that it never becomes part of their mental equipment. This sceptical outlook is really evidence of a sound critical faculty, in comparison with which the mental attitude of many of the mathematically minded towards vector algebra seems like credulity. The engineer who hesitates to use a calculus the basic principles of which he does not understand is acting correctly. Popular explanations often beg the question and assume to be proved that which is really unprovable. The short discussion of the elementary principles of the subject on another page will, it is hoped, assist those who, not being mathematicians, yet find it of practical advantage to use vectors.

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**Sulphur in the Air**

THAT there has been a definite trend towards a cleaner atmosphere in Great Britain during the past twenty years is the conclusion reached in the twenty-second annual report on "The Investigation of Atmospheric Pollution" carried out by the Department of Scientific and Industrial Research (Stationery Office, 6s.). Sulphur gases are believed to be a considerable cause of the deterioration of buildings, and possibly of ill-health also. Their proportion is greater in the winter, which, the report suggests, indicates the domestic fire as a contributory agent, although there are other sources of sulphur that do not reveal themselves by adding to the general murkiness, and industrial furnaces are under suspicion. It is also pointed out that generating stations also burn more in the winter months. The validity of any inference that might be drawn from this comment will be tested when a greater proportion of the electricity used in London (which has the worst record of any town) is drawn from the Battersea and Fulham stations, which are equipped with sulphur-elimination plant.

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**Irish Lamps**

IN accordance with the present world tendency the Irish Free State (or "Eire," as it is to be called) aims at self-sufficiency. A country which is primarily agricultural naturally finds the realisation of such an aim extremely difficult. Only by severe forms of protection can a new manufacturing industry compete with the products of established overseas concerns, and even then the cheapness of certain suppliers' goods negatives protective efforts. This has happened in the case of electric lamps. Just over two years ago a company was formed with the object of producing all the electric lamps required in the Free State. For a time optimistic views were expressed as to the company's future, for heavy duties were placed on imported lamps, while supplies were restricted by a quota system. Lately, however, it has become evident that the company's prospects were not so bright as they had appeared to be, due to the influx of cheap Japanese lamps. An appeal to the Government for an embargo has, so far, proved unsuccessful; the company finds itself with stocks sufficient to meet demands for several months and, consequently, has decided to close its factory indefinitely.

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**Tariffs Again**

IN the electricity supply industry tariffs are as contentious a topic as they were once in politics. In this issue the subject is taken up by Mr. F. R. Jervis, who expresses opinions formed as the result of an inquiry among 44 of the largest supply undertakings representing a substantial proportion of the whole industry. From the replies received it is apparent that the rateable value method of assessing the fixed charge is the most popular although it has disadvantages—in common with other systems. The rateable value of premises is hardly a fair measure of the cost of service to the tenant, which it is the authority's aim to recoup. It depends very largely (apart from size) on amenities and situation—two aspects remote from electrical considerations. Attempts are made by some authorities to adjust outrageous differences by stepped scales but these do not always work equitably. However, the rateable value basis has secured a firm hold and will not easily be dislodged.

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**Closing Circuit-Breakers**

THE importance of arcing time in relation to the safe operation of switchgear is too often overshadowed by considerations due to the magnitude of the kVA which may be dealt with under fault conditions, and the prolongation of the time before an arc is quenched has probably been the cause of several failures of circuit-breakers at less than their rated capacity. Of the significant factors underlying switchgear design and operation, none is of greater moment than those connected with making circuit. The risk to the operator is usually greater than when a switch trips due to short circuit, especially as the current may rise to a greater value than it can in the other case. Moreover, the effect may be exaggerated if there is any hesitancy on the operator's part or difficulty in pushing the contacts properly home.

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**Heat in Industry**

THE scope offered to electrical development by the use of electricity for the many industrial processes that require heat is so enormous as to make it appear that it is only necessary to arouse enough interest in the subject to make considerable strides. It is the duty of E.D.A. to arouse this interest, and so it is the appropriate body to form the British National Committee of the International Institute of Electric Heat and Electrochemistry, which has come into being as a result of the Congress held in Holland last year. This year's meeting is to be held in Paris and it is hoped that the next will be in England. As the choice of electricity for providing heat so often depends on making a case from process improvements against a higher B.th.u. cost, any information derived from wide experience is especially to be desired, and the international aspect of the new body should, therefore, have a distinctly utilitarian value.

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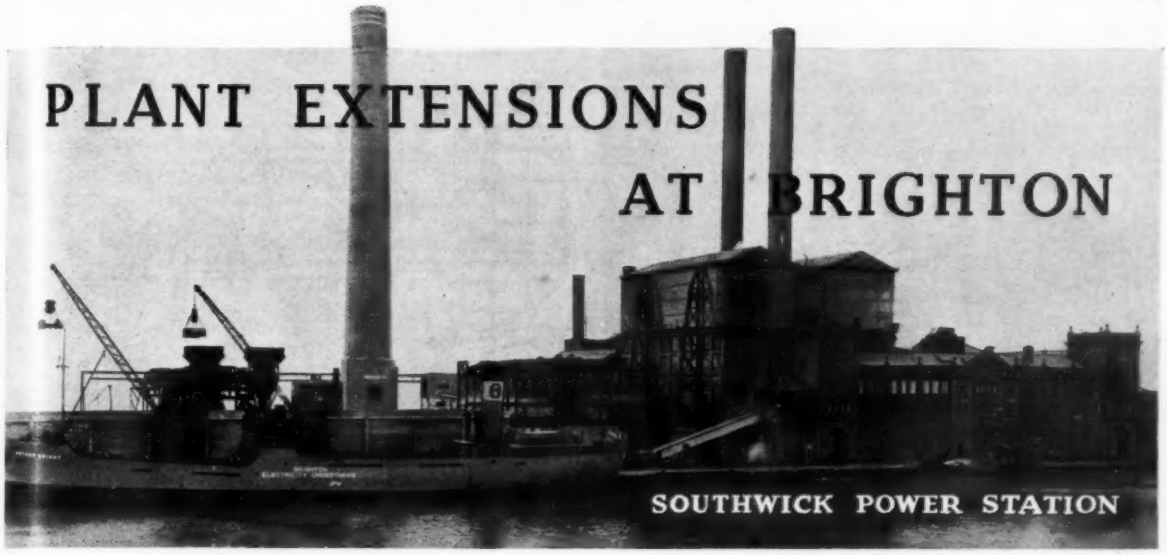
**A Change of Venue**

IT had been arranged that the Electrical Contractors' Association should hold its annual conference at Blackpool this year. Circumstances have arisen, however, that make this impossible and, as a result, the Association is again to visit Llandudno. The period of the conference—June 23rd to 25th—has not been altered. It is seven years since the last E.C.A. conference at Llandudno, which was a most successful affair. We trust that this year's conference will be as enjoyable.

# PLANT EXTENSIONS AT BRIGHTON



SOUTHWICK POWER STATION

UNTIL three years ago the Southwick power station, Brighton, was operated by efficient boiler and turbine plant at 350 lb. per sq. in. steam pressure. Then came an extension of three 150,000 lb. per hour Stirling boilers operating at 675 lb. per sq. in. and 875 deg. F. and a 30,000-kW Parsons turbo-alternator. That meant that the comparatively new 15,000-kW set could not be run from the new h.p. boilers, and this difficulty was overcome by installing a back-pressure turbine to drive one of the original 6,500-kW alternators.

This turbine will receive steam at 650 lb. per sq. in. and exhaust it at 350 lb. per sq. in., thereby enabling an additional 4,500 kW of load to be taken from the new boilers. Across this pass-out turbine is fitted an automatic reducing valve which, operated by the governor system, takes care of the load variation. Further, a hand-operated reducing valve can be used independently.

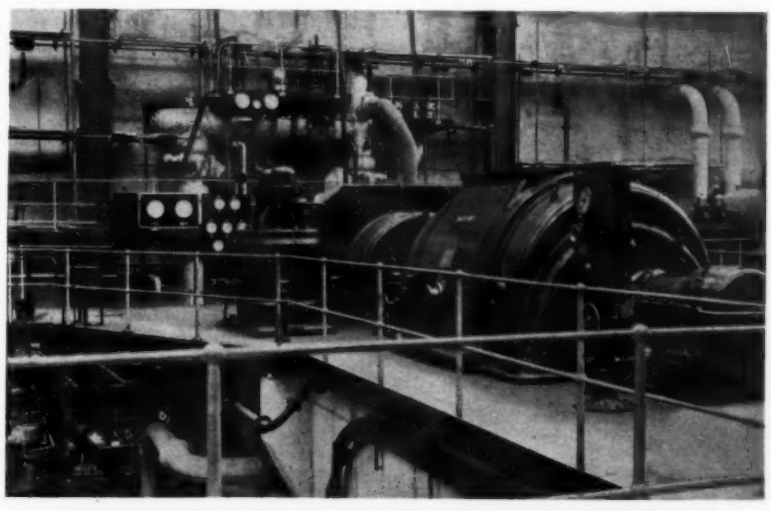
The next extension was a fourth 150,000-lb. per hour boiler for the same steam conditions and a Brush-Ljungström turbo-alternator, which is to be put into official commission to-day (Friday). During the preliminary running on load over the first few weeks the set has proved itself capable of dealing with 40,000 kW. Rating the new set at 37,500 kW, the present capacity of the station is 89,000 kW, and with the projected two additional sets of similar capacity the final station capacity will be 164,000 kW.

The new Brush set has replaced one of the original sets at the permanent end of the turbine room. An extension at the other end of the turbine room will accommodate the two further sets, one of which is already on order. The extension will increase the turbine room length by 90 ft. Over 1,000 piles were driven for the reception of the foundations, and the building structure is of steel girder framework with a filling of cement plaster on expanded metal. This means a great saving in weight with a general appearance in conformity with the older part of the power station. A new chimney has been erected and this stands on a nest of 90 piles.

Excavation and foundation work is also proceeding for two new 175,000 per hour Babcock & Wilcox boilers, and with the new boiler-house extension there will be two higher structures at either end of the older boiler plant, which includes the pulverised-fuel equipment. These two modern sections will be bridged over the lower central portion to accommodate the coal conveyor.

The original hydro-jet ash-removal system has had to be augmented to cope with the extensions and the telpher system and ash pits have been repositioned to make way for the new boilers. Two new 30,000-gal. per hour circulating pumps (Mather & Platt) are also part of the new extensions. The new set is consuming about 8.4 lb. of steam per kWh, but accurate tests have not yet been taken. Although the station is running at about between 22 per cent. and 23 per cent. overall efficiency, this figure is steadily being improved upon as the duty of the new set is increased, and, of course, it will be further improved with the installation of the plant to come. The coal consumed at the station last year amounted to 1.26 lb. per kWh generated.

During the greater part of its expansion the steam in the new turbine flows in a radial direction through concentric rings of reaction blading secured alternately to the faces of a pair of oppositely rotating discs, each of which is overhung from the inner bearing of one of the two half-capacity alternator rotors which are driven by the turbine. Each disc comprises three main sections connected by radial bolts to permit relative expansion and contraction without distortion that might otherwise result from subjecting a single disc to the same steep temperature gradient. In each turbine there are 57 rings of radial-flow blading and two axial-flow single-rotation low-pressure stages. The central position of the turbine in its casing enables a double flow to be employed for these last stages, each turbine disc carrying two rows of axial-flow blades in addition to its share of radial-flow rings. The four rows of stationary guide blades are carried in a frame built up of steel plates and supported in a central position in the turbine casing. There is no high-pressure casing and the complete blade system is contained in the unlagged low-pressure casing.



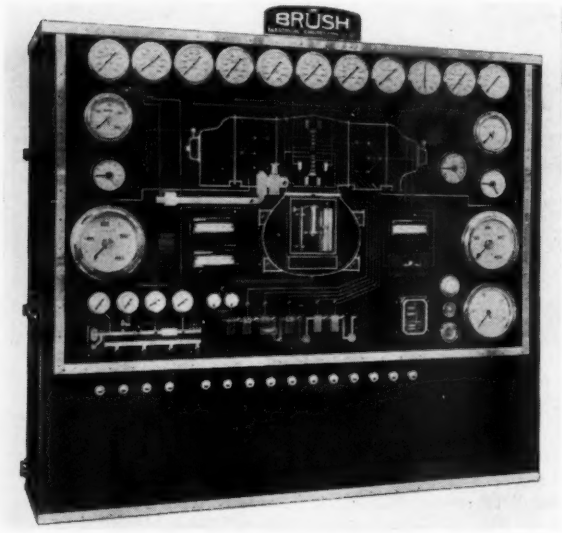
The 6,000-kW pass-out turbine; steam reducing valve and pipework in rear

The steam flows through the emergency stop valve, and the governor-controlled throttle valve to the forged steel steam chests, each of which has three concentric annular compartments which communicate through holes in the labyrinth packed balancing discs, and in the turbine discs themselves, with different stages of the blading. The overhung spindle which carries the turbine disc passes through the central chamber, and the space between the spindle and the steam chest is occupied by labyrinth shaft packing.

The main steam supply at the most economical load of 30,000 kW passes from the inner compartments of each chest to the inside of the first ring through holes in the hubs of the discs. The next two connections, one from each chest, are used for the admission of additional steam from the middle compartments to lower-pressure stages of the turbine to enable

the maximum continuous rating to be carried. Two others are used for bleeding steam from the turbine to the high-pressure feed heaters. Low-pressure heaters are provided to take steam bled from two still lower-pressure points of the blading.

The condensate passes in series through the main ejector condensers, a low-pressure heater, a gland heater, a drain

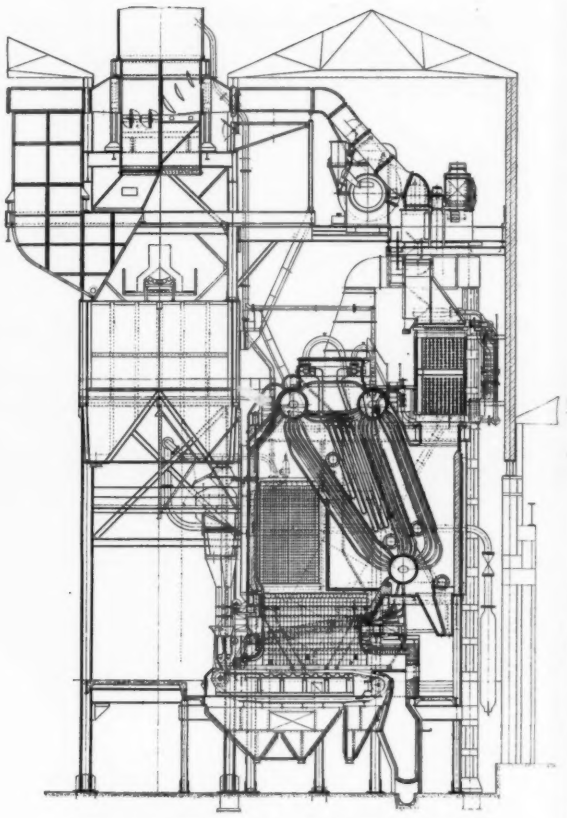



**Control board for the new Ljungström set**

cooler and another low-pressure heater to the low-pressure boiler feed pumps. From there it passes through the two high-pressure heaters to the high-pressure feed pumps. The condensate temperature at the discharge of the last heater is 340 deg. F. at the maximum-efficiency loading of the turbine.

The divided two-pass condenser is designed to maintain a vacuum of 29 in. at a load of 30,000 kW and has a total surface of 37,100 sq. ft. Duplicate 55-h.p. motor driven vertical extraction pumps are each capable of withdrawing 550 g.p.m. of condensate and delivering it to the suction of the low-pressure feed pumps against a total head of 131 ft. Instead of the usual size of atmospheric exhaust valve for a turbine of this capacity, a system for gradually and automatically unloading the turbine as the vacuum falls below 24 in. of mercury incorporates an 8-in. atmospheric valve.

The alternators are rated for a combined output of 37,500 kVA, 0.8 p.f., 8,000 V, 50-cycles, 3-phase, 1,500 r.p.m. The stators are connected permanently in parallel and the rotors

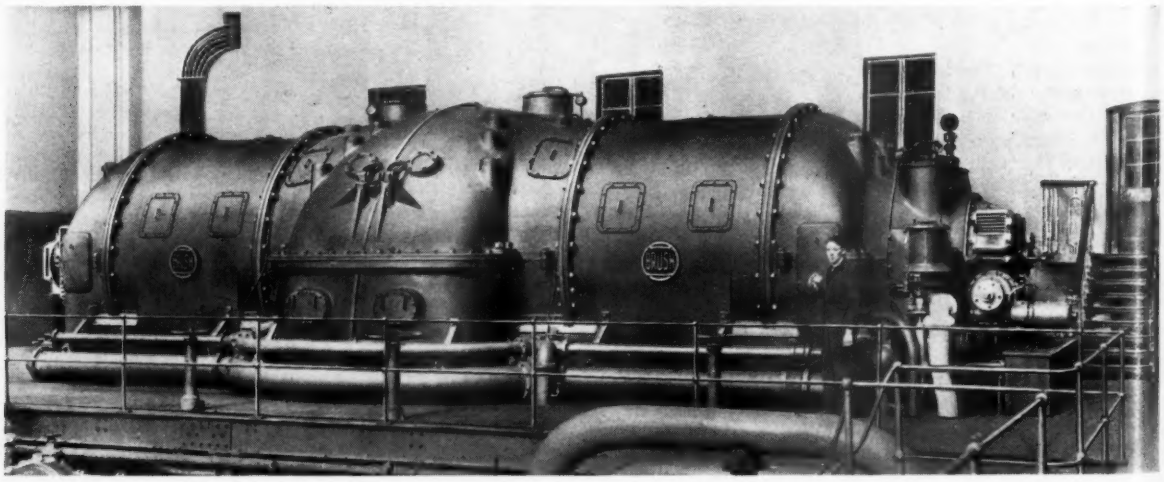


**The arrangement of the Brighton boiler plant**

180,000 lb. The forged drums are all 42 in. in diameter, the front steam drum and the mud drum being 3 in. thick and the rear steam drum 3¾ in. thick. The 668 main generation tubes are 3¼ in. outside diameter and 4 s.w.g. thick.

An L-type stoker, 24 ft. wide by 18 ft. 6 in. long, has a grate area of 444 sq. ft. and is driven by a 3-h.p. 900-1,100 r.p.m. motor. The secondary air fan is driven by a 12½-h.p. 1,440-r.p.m. motor. From a convection superheater between the first and second tube banks, with a heating surface of 4,422 sq. ft., the steam passes to a Bailey radiant superheater fitted on each side of the combustion chamber by which the temperature is raised by a further 75 deg. F.

Behind the boiler is a Senior economiser of 13,280 sq. ft.,



**The new 37,500-kW Brush-Ljungström set which is being inaugurated to-day**

are connected electrically in series and mechanically coupled directly to each half of the turbine blading. The alternators are controlled by switchgear made by the Metropolitan-Vickers Electrical Co., Ltd.

## The Boiler Plant

The boilers for the extension were installed in advance of the turbo-alternator. The latest is of the Stirling tri-drum type, with a boiler heating surface of 13,459 sq ft., a normal evaporative duty of 150,000 lb. per hr., and a m.c.r. of

immediately above which are two Howden-Ljungström preheaters, each with a heating surface of 9,450 sq. ft. The combustion chamber (8,750 cu. ft.) is fitted with Bailey water-cooled side walls. The front wall is also water-cooled and covered with Bailey blocks to a similar height as the side walls. Two forced-draught fans of Howden-Turbovane single-inlet construction have individual maximum duties of 34,000 cu. ft. of air per min. Each is driven by a Laurence-Scott two-speed 970-930 r.p.m., 83-36 h.p. motor with Tate remote control. The two induced-draught fans of the same make are of the double-

# Colliery Illumination

## By J. W. Howell, D.L.C., A.M.I.E.E.

### Intensities required for various purposes

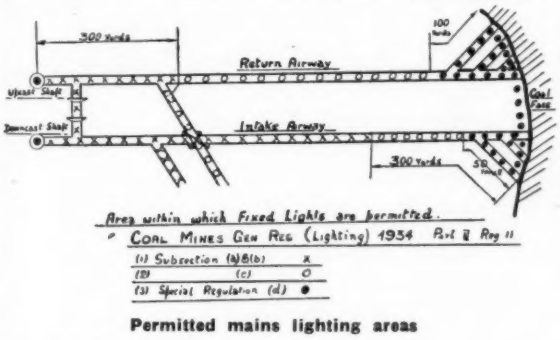
SCIENTIFICALLY designed lighting schemes can be so formulated that pre-determined results can be obtained and standards achieved which leave practically nothing further to be desired, but the lighting of mines is far more difficult. In surface works acid fumes are often present, while underground inflammable gases, the transient nature of the workings, and the almost negligible reflection from surfaces constitute a formidable array of obstacles to the illuminating engineer.

Until recently no great effort had been made to improve upon the lamentably low candle-power of safety lamps and this, together with the fact that portable lamps have to be placed some distance from the coal face in order to avoid damage, reduced the effective illumination to an almost negligible quantity. The amount of light reflected is probably not more than from 3 to 5 per cent. Light of this order produces conditions which materially affect the health of the miner, giving rise in certain cases to nystagmus.

### Surface Lighting

Good lighting at the pithead and in surface workings is essential, for safety below often depends upon the efficient operation of surface plant, faults in which may seriously jeopardise life below ground. The Coal Mine General Regulations (Lighting), 1934, require that effective provision shall be made for securing and maintaining sufficient and suitable lighting in places where persons regularly work. Generally, the mine surface lighting question is similar to industrial lighting.

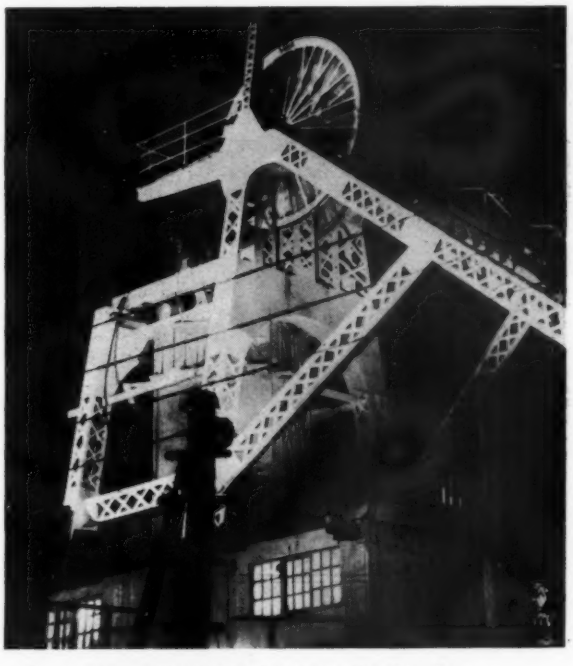
The layout of plant for power and boiler houses will usually allow the use of a general overhead system with reflectors of




**Permitted mains lighting areas**

the standard dispersive type, supplemented where necessary by additional lighting, as in the case of narrow firing aisles. The illumination should be from 5 to 10 ft.-candles. The lighting of wagon roads is rather more difficult, for owing to low head room and a fairly considerable amount of dust, open type reflectors should be avoided. Totally enclosed projectors with their high efficiencies will be found advantageous, the desirable illumination for this application being not less than 2 to 4 ft.-candles.

On picking belts great assistance can be rendered to coal pickers if suitable lighting is installed. Experience proves that colour correction of the light is necessary for most types of coals, for, owing to the large proportion of red and yellow



**The floodlighted pithead at Westhoughton**

light rays emitted from the ordinary gasfilled lamp, the detection of shale is extremely difficult. In some cases "daylight blue" lamps have been used successfully for this purpose, while in others visor fittings have been necessary. Until recently this was the limit of assistance which could be given, but with the introduction of the high-pressure mercury electric-discharge lamp a radical change in picking belt lighting has been brought about. The illumination of belts should be from 15 to 25 ft.-candles.

Yard lighting can only be effective by using some form of floodlighting. It is true that some collieries still use centrally suspended fittings over rail lines, the fittings in themselves being nothing more than a protection from rain, etc., and totally ineffective so far as light distribution is concerned. Use should be made of a non-ventilated type of projector which, provided machined housings are fitted, should be sufficiently air-tight to prevent the entry of acid-laden air with consequent peeling of the reflecting surface. Rail sidings and yards should be lighted to an intensity of not less than 0.5 to 1 ft.-candle.

### Underground Lighting

A great deal can be done to improve the standard of underground illumination, for mains lighting can be shown to be economical, and there is no logical reason why extensive developments should not occur in this field. The present regulations do not allow mains lighting up to the coal face, excepting where special exemptions have been made and certificates granted to that effect by the Mines Department. The majority of mines rely entirely on miners' hand lamps or cap lamps for illumination purposes below ground, which, even with the improved lamps now available, fall far short of an ideal system.

The necessity for speedily recognising the presence of moving conveyances, either mechanically propelled or horse drawn, is evident, and in this respect evenly distributed illumination is much more conducive to safety than individual miners' lamps. In view of the restrictions on head room, the bulkhead type is eminently suitable and gives a wide lateral distribution of light. The fittings themselves usually have a prismatic glass with a smooth exterior, which greatly facilitates cleaning, and house lamps of 40 or 60 W. This type of fitting has a big advantage over the well-glass type: first, because of reduced projection, and, secondly, because of the removal of the light source from the line of vision. The advantages of whitening the top and sides of haulage roads to assist in securing a better reflection factor are also becoming widely appreciated.

From a visual standpoint the mains lighting system is superior at the coal face to any other, for it can be made relatively glare-free. At the same time, the light can be controlled and thrown in a downward direction, eliminating discomfort occasioned by the use of portable equipment. Under poor lighting conditions, say below 0.001 ft.-candle, objects appear in silhouette, with a ghostly aspect similar to a moonlit landscape. It is certain that if this latter condition is present it will be fatal to efficient seeing and will result in

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**Plant Extensions at Brighton** (*Concluded from previous page*)

inlet type with scroll dust and secondary collectors, and are capable of dealing with 56,700 cu. ft. of gas per min. The motors are similar but are of 78-175 h.p. each. Allen West instruments, Dewrance mountings and Babcock soot-blowers of the valve-in-head and Clyde single-nozzle type are installed.

After leaving the induced-draught fans the gases pass through a gas-washing plant and thence to a chimney 11 ft. 2 in. inside diameter and 200 ft. above the firing floor which serves two boilers.

The two 175,000-lb. B. & W. boilers required for the further extension mentioned above will each have a heating surface of 8,040 sq. ft. and similar steam conditions, but they will incorporate Babcock direct-firing pulverised-fuel equipment and Bailey hopper-bottom furnaces.

The specification of Mr. W. N. C. Clinch, borough electrical engineer and manager, embodied all the requirements of the station for feed heating and included the arrangements for bleeding the turbine at four points.

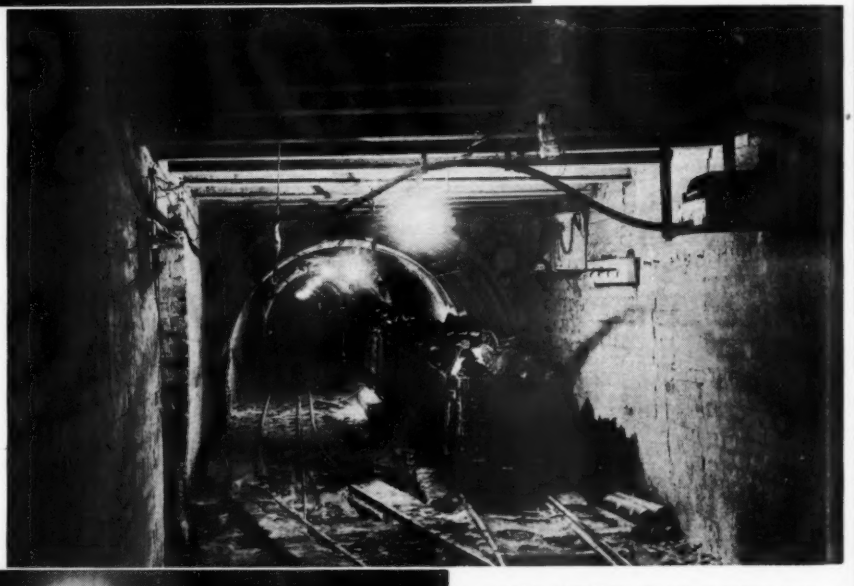
loss of confidence, followed by the possibility of serious accident.

Portable equipment gives only a very small illumination in its immediate neighbourhood and results in the eye being expected to operate under distinctly unnatural conditions, with

**Conveyor belt in the mains-lighted Steetley pit**

consequent increase in eye troubles. Conditions which permit even field brightness are therefore superior from the visual standpoint to those where heavy contrasts are present, as in the case of the portable lamp. It can be taken roughly that a 40-W lamp enclosed in an opal well glass will have a resultant brightness of 2 candles per sq. in., while that of the miner's lamp, even with a pearled funnel glass, is about 50 candles per sq. in.

Good lighting conditions will react beneficially upon the miner. Competent authorities have suggested that the illumination on the coal face should be at least 0.4 ft.-candle.



**Mains lighting in the haulage road (Steetley)**

**The picking belt at Shireoaks Colliery lighted by mercury-vapour lamps**

Where tests have been made over prolonged periods it has been conclusively proved that a reduction of accidents has been attained where improved lighting systems have been installed. Direct evidence has been obtained during recent experiments carried out at the Steetley Colliery of the Shireoaks Colliery Co., Ltd.

In this instance the number of accidents reported per month since the introduction of machine mining at the coal face has been recorded. A percentage reduction of 82 occurred, the accidents falling from 22 in March, 1934, to four in September of the same year. The actual saving was 0.3d. per ton of coal raised.

In the case of Steetley and Langwith it is claimed that improved lighting has resulted in increased safety, while, in addition, some small increase in the rate of stripping and filling has been observed. In addition, roof conditions, &c., are generally easier to observe at the coal face and there has been widespread appreciation by the colliers of the successful experiments conducted.

## Increased Production

Owing to conditions in this country no production figures are available, but a fairly conclusive case is given from the Wenceslaus mine in Germany. In this case the quality of the material raised has greatly improved, for, while the increase per man shift due to better lighting was over 12 cwt., the amount of shale sent to the surface was reduced by almost half. Actually, an average increase of 25 per cent. in coal raised was recorded, the tests extending over a two-year period. Considerable experience has been obtained in Germany with mains lighting at the coal face, some 200 pits being illuminated in this manner. A formula for coal-face lighting which appears to correspond closely with tests is as follows:—

Spacing of lamps (in yards) = (2 × thickness of seam in feet) − 1.

Size of lamp (in watts) = (spacing of lamps in yards)$^2$.

As an example, a 5-ft. seam may be taken. Then the lamps would be spaced at a distance of (2 × 5) − 1 yard = 27 ft., and the lamp wattage = $9^2$ = 81 watts. This enables the results to be expressed in terms of wattage per sq. ft. of coal face = 81/5 × 27 = approximately 5-9ths watt per sq. ft. It would appear that this figure is fairly accurate for tests by Atkinson and Allsop at Steetley showed that 750 W per 100 yards of face gave a reasonable degree of intensity of illumination.

Taking a general survey of the results of various tests and bearing in mind that the economic limit for the lighting cost per ton of coal raised is around 0.6d., it will be seen from Table I that Steetley Colliery gave good results.

In this case all comparisons have been estimated on a 5-ft. seam, for one would expect a greater output from a deeper

seam than from one of small dimensions. Bearing in mind the reduction of 0.3d. at the Steetley Colliery, due to decreased payment of compensation, the net cost is about 0.3d. per ton of coal raised. It would appear, therefore, that sooner or later handlamps, excepting for special purposes, will become obsolete and the improved means of obtaining more and better light distribution will become an accepted system in modern coal mines.

## Coal Face Equipment

It must be clearly understood that in the following particulars no attempt has been made to discriminate between various manufacturers, the text being merely indicative of various types of the available equipment. For working positions there are several necessary and desirable features, such as portability, robustness, compliance with Buxton specifications, safety from shock, satisfactory isolation without cutting off the whole of the lighting, and protection from tampering.

Three circuits are generally in use. When working at a mains voltage of 100-125 the coal face lighting circuit in electrical cases would obviously be controlled from a flameproof coal-face switchboard which, in addition, would control the whole of the electrical equipment employed. So far as the lighting side is concerned the unit would probably consist of an airbreak knife switch and fuses for the control of the high-voltage side, fitted with an air-cooled 1½-kVA single-phase lighting transformer stepping down to 110 V with a double pole contactor for the control of the secondary side, with the necessary operating relays from the system.

TABLE I.

| Type of lighting. | Place. | Assessed cost per ton of coal raised for 5ft. seam in pence. |
|---|---|---|
| 150 watt mains lighting ... | Wenceslaus | 1.157 |
| 60 watt mains lighting ... | Steetley ... | 0.582 |
| 36 watt pneumatic lighting | Langwith . | 0.827 compressed air from mains. 0.712 inbye compressor. |
| 36 watt pneumatic lighting | Norton ... | 0.724 compressed air from mains with low charge. |

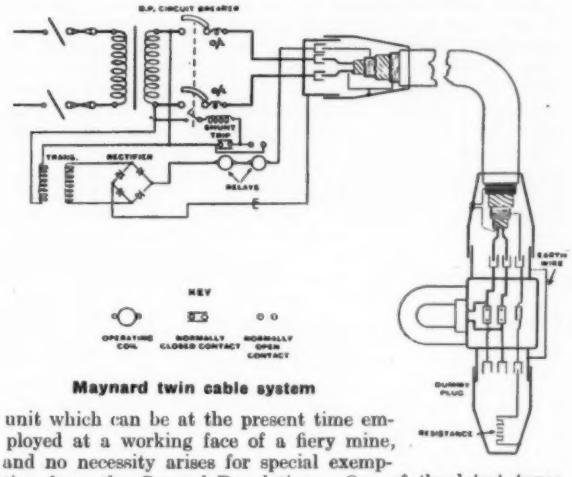
A suitable portable transformer, which through its portability reduces the lengths of low-voltage cabling necessary, would be of 75-kW oil-immersed, with flameproof control switches at either end and adapted so that it can be easily transported from place to place. Where temporary attachment is necessary a new plug has been patented and has received the Buxton certificate.

A bayonet attachment is supplied in the removable socket attachment which is fixed to the lamp unit. When the plug is screwed home in the socket the contact is made within the flameproof enclosure, and when withdrawn the spring-loaded contact portion breaks the circuit before the plug is withdrawn completely, thus preventing open sparking. This enables fittings to be disconnected singly and moved onwards.

In the second case the mains supply is stepped down to 25 V, at a special flameproof switch, by a transformer to 44 V between phases. The neutral of the secondary side of the transformer is earthed, the lamps being connected from phase to neutral. If an earth fault occurs in one phase only a third of the lights are cut off. The supply is by four-core pliable armoured cable, the lighting fittings being sectionalised into banks of three. The size of lamp generally used is 30 W, while protection is given by a glass cover. The lamp itself is surrounded by a gauze bulb. Should an explosion occur within the gauze bulb, the hot gases passing through will be cooled by expansion, &c., and rendered sufficiently low in temperature on reaching the external atmosphere as to be free from danger.

The lamps used in the third case are self-contained, consisting of a metal case housing a revolving field alternator driven by a compressed air turbine, a pressure of about 50 lb. per sq. in. being utilised inside the lamp. The generator has an output of 36 W at 12 V, the lamp housing a standard 36-W double contact automobile head lamp bulb, which is protected by a glass dome. The air consumption of the lamps is approximately 4 cu. ft. of free air per minute at a pressure from 40 lb. per sq. in. upward. A larger size of this lamp is available if required, but this type is recommended for coal-face work.

This system is claimed to be the only high-power lighting unit which can be at the present time employed at a working face of a fiery mine, and no necessity arises for special exemption from the General Regulations. One of the latest types of flameproof lighting fitting is filled with carbon dioxide under pressure, the gas being introduced by means of a small steel cartridge containing from 1.5 to 2 grammes in liquid form. The pressure inside the fitting is between 8-12 lb. per sq. in., increasing to between 17 and 23 lb. when the lamp is on. Should breakage occur the pressure inside the bulb will fall rapidly, the filament being surrounded by $CO_2$, which will prevent ignition of explosion gases. The lamp cannot be switched on without the well glass being in position and undamaged.

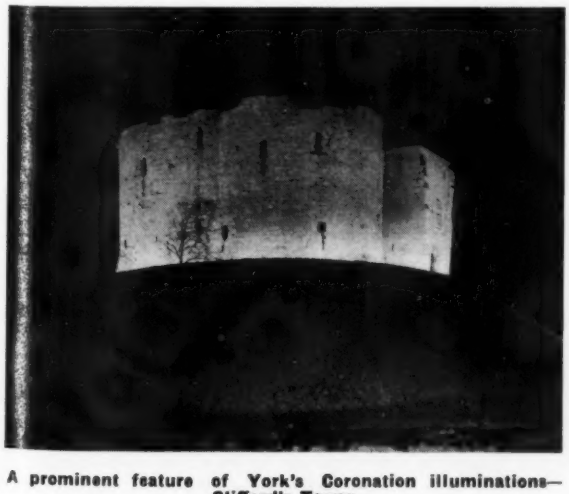



**Maynard twin cable system**

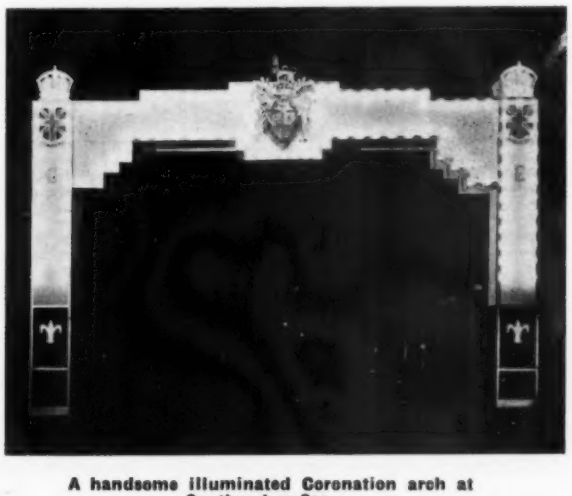
The equipment is fed from the mains, stepped down to 125 V, 3-phase, 50 cycles at intervals of 5 to 10 yards, the cable being teed off and each lamp fitting connected to the junction by a suitable length of "wander" cable.

One of the safest protective systems yet evolved is the "Maynard," which consists of a twin cable, suitably insulated, with two concentric sheaths or screens of wire surrounding them, these sheaths being insulated from the cores and from each other. The outer screen, which is the earth, has a minimum sectional area of 0.022 sq. in., the inner screen being the pilot screen. The schematic circuit shows one lighting unit, together with a transformer unit, cabling and control apparatus.

There are two relays in series, one of which is normally closed and the other open. These relays are wound to different resistances, so that one operates with the small current which is used for maintaining the circuit and the other with the increased current caused by a short circuit between the cores. Thus, unless the screen curtain is switched on and maintained, the control switch will be tripped and, secondly, if the screens are shorted the control switch will be also tripped.



**A prominent feature of York's Coronation illuminations—Clifford's Tower**



**A handsome illuminated Coronation arch at Southend-on-Sea**

# Current Transformers for Metering.

By A. Hobson, B.Sc.(Tech.)

CURRENT transformers for metering use have improved out of all knowledge during the last few years, due almost entirely to the discovery of the nickel-iron alloys. With the original silicon-iron cores it was difficult to reduce the phase-angle error to less than, say, 20 minutes, and even this was expensive, involving a design with upwards of 1,000 ampere-turns and liberal core section. Nowadays, phase angles of one minute and less are quite common.

A few years ago it was almost universal practice to use Class B and Class C transformers in metering circuits. Very few present-day meter engineers are satisfied with anything less than Class A current transformers, while many insist on much better accuracy than this, especially when large blocks of power are being measured. In such cases even a very small metering error can easily mean a considerable loss of revenue to the supply authority.

Before the advent of nickel-iron the problem of accuracy led to a great deal of research on current transformers. As a result quite a number of "compensated" transformers were put on the market which were claimed to ensure better accuracy for a given amount of material. Most of these compensated transformers were devised on the same basic principle, *i.e.*, the core was "pre-magnetised" to a flux density approximating to that causing maximum permeability of the iron. The working flux was superposed on this, and a reduction of the iron loss and magnetising current was thereby effected. The first graph affords a rough idea of the principle involved; the areas of the small loops represent the respective iron losses.

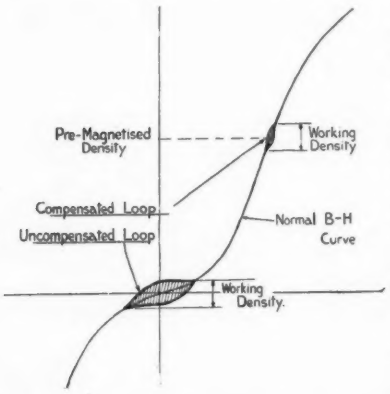



**Fig. 1.—Effect of pre-magnetising cores**

Such compensated current transformers did actually work quite well, but they suffered from several disadvantages. Two or more cores and windings were always necessary, together with complicated interconnecting; also a small resistor or choke had to be fixed on somewhere and, furthermore, owing to variations in the performances of different cores, each current transformer had to be calibrated individually.

As a result, the cost of such transformers, despite the saving in material, was eventually quite as much as that of "straight" type and, in addition, other undesirable features appeared. If the burden were changed, for instance, the whole characteristic of the transformer would be altered.

Perhaps the most useful purpose of the compensated current transformer was that it permitted the simple ring type of construction to be used for lower primary currents than was hitherto possible. Indeed, this advantage was so eagerly "rammed home" by the various inventors that for a few years many engineers were scared of having wound-primary current transformers on their systems.

Fortunately, this prejudice has died down, and it is generally realised now that, provided certain broad principles of design are observed, the wound type of current transformer is an extremely safe and reliable piece of apparatus. At the same time it must not be forgotten that the ring transformer has definite advantages over the wound type in that it is much simpler to construct and insulate; also that, even under the very worst short-circuit conditions it is not subjected to mechanical stress. In this connection nickel-iron cores have proved an invaluable aid, and it is now possible to supply ring transformers down to 100/5 A and less which have accuracies comparable to those of 600/5 A units using silicon-iron.

## Comparative Performance

The second graph compares the magnetising currents of nickel-iron and silicon-iron, plotted to the same scale, between 0 and 5,000 lines per sq. cm. This covers the normal range of flux densities used in current transformers. Above 5,000 B the nickel-iron curve begins rapidly to approach the other. Between about 7,000 and 8,000 they cross, and past this point the silicon-iron has the better performance. This explains why silicon-iron is still used for power transformers. Had it been possible to maintain the remarkable properties of nickel-iron at about 14,000 lines per sq. cm. it would no doubt have supplanted silicon-iron entirely.

## The use of nickel-iron alloys

The phase angle of a current transformer is roughly proportional to the magnetising current. This, at B=2,000, means that a transformer with a nickel-iron core will have about one-tenth the error of a similar unit built of silicon-iron. A study of the comparative iron loss curves would reveal a similar reduction in ratio error. Fig. 3 indicates the phase-angle errors of two such transformers. Of course, such a high accuracy as that shown by the lower curve is not always wanted. When it is, the designer uses a mixed core with a suitable proportion of each metal. The nickel-iron curve, besides showing smaller errors, is much flatter than the other. This is of great importance in the calibration of meters, as the meter engineer is enabled to obtain practically as good accuracy on light loads as on full load. This flatness of curve was one of the main features claimed by the inventors of the compensated transformers, but nickel-iron has set an entirely new standard.

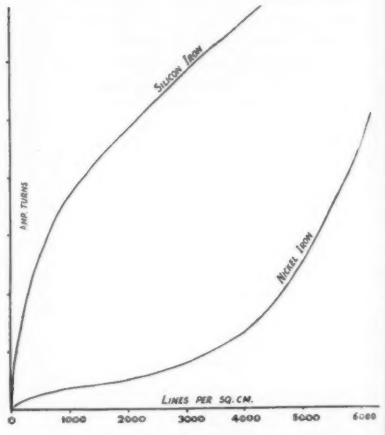



**Fig. 2.—Magnetising current curves of nickel-iron and silicon-iron**

The properties of nickel-iron can be used in another way besides the mere obtaining of accuracy. Current transformers can be worked at much greater flux densities for the same accuracy and thus, when necessary, it is possible greatly to reduce the size and simplify the design. This is especially applicable, as previously stated, to low current ring transformers. Fig. 4 shows the phase-angle curve of a 100/5 A transformer of the ring type having dimensions of 3 in. in diameter, 3 in. long. A silicon-iron wound transformer to give equivalent performance would be about 6 in. by 6 in. by 8 in.

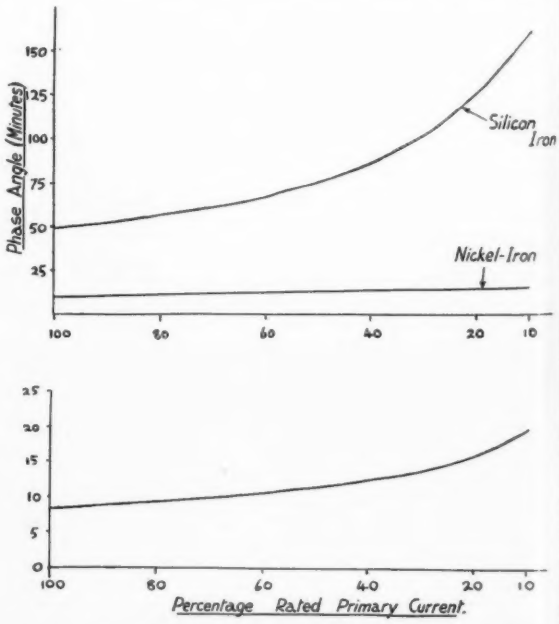






**Fig. 3 (top).—Comparison of silicon-iron and nickel-iron transformers. Fig. 4.—Phase angle of ring current transformer, 100/5 A, nickel-iron ore**

The cost of nickel-iron ring cores has been greatly reduced by the adoption of the "clock spring" formation. Nickel-iron is quite a soft alloy and, instead of having special tools for each size of ring and stamping out each lamination, it

has been found practicable to wind the cores on a former of the required size with a strip of suitable width. This saves about 50 per cent. in waste metal to begin with and, further, cores of any inside and outside diameters can be obtained without tools. But for this method it is safe to say that the use of nickel-iron would be much restricted on account of expense.

### Modern Practice

Meter engineers are rapidly taking advantage of the improved accuracies which manufactures can offer them. Classes B and C transformers are giving way to Class A and even better accuracies. Engineers find it a good plan to install a complete current transformer testing set and to test each transformer they buy. This saves a lot of time and expense when the meter operated by a transformer becomes faulty and has to be replaced. All that is necessary is to calibrate the new meter to suit the transformer curve. The meters can then be changed on site without interrupting the customers' supplies, the process taking about five minutes.

Contrast this with the old method, when the transformer and meter had to be taken out of circuit and removed to the test room for calibration. To do this the customer's supply had to be cut off for removing the transformer and again when putting it back, or else the whole job had to be done at night when the load was off. Thus two visits to the site were necessary, with considerable inconvenience to the consumer and expense to the supply authority.

The very latest practice, employed by one of the largest undertakings, is to use current transformers of such extreme accuracy that the effect of their errors on the meters can be disregarded. The transformers can then be installed and forgotten. This system has three advantages. First, meter testing is easier, as there are no transformer errors to be allowed for. Secondly, the changing of faulty meters is greatly facilitated. Thirdly, all the meters on the system are calibrated alike and are interchangeable.

A few years ago the prohibitive cost of precision accuracy transformers would have prevented this scheme being used. Naturally, precision transformers still cost more than ordinary ones, but the difference is not nearly so great as it was, and the advantages of the scheme far outweigh the increased initial cost.

# Diesel-driven Power Plants

## Tannery and printing works installations at Yeovil

MECHANICAL methods in the tannery have developed side by side with hand-processes that are centuries old. In the dressing yard of Atherton and Clothier, Ltd., at Yeovil, most of the power required was formerly obtained from two 30-b.h.p. gas engines, but electricity was taken from the public mains for lighting and for driving a 30-h.p. motor.

As the gas engines needed replacing, a two-cylinder 110-b.h.p. Petter blower-scavenge Diesel engine was put into operation in October, 1936. This engine is connected by two flat belts to a generator providing energy for lighting and for the motors that drive the groups of machinery and to the adjacent line shafting.

Last December, for example, in 251 running hours 648 gal. of fuel oil at 5½d. cost £14 17s. and 6 gal. of lubricating oil at 3s. 5d. cost £1 0s. 6d., making a total of £15 17s. 6d. This figure represented a saving of £10 per month over the estimated cost of electricity purchased from the public service. Staff wages were inappreciable as the engine receives only occasional visits from the engineer.

**Treating skins in the tannery (top). The machines are electrically driven, the 110-b.h.p. Petter blower-scavenge Diesel engine (right) being connected by two flat belts to a generator. The other photograph is a general view of the printing works**

The bulk of the engine is little more than that of a high-speed unit of similar output. Exhaust gases are taken through a small manifold bolted to the cylinder housing (as the air-scavenging system does not call for a large silencer close to the engine) to a Burgess silencer outside the engine room. The compressed-air starting mechanism is controlled by a single lever. Cooling water is circulated by a built-in pump. The maximum variation in engine speed is 10 r.p.m. when all the dressing wheels happen to be in use at one time and no flicker on the lights is noticeable.

A 16-b.h.p. Petter harmonic-induction engine is installed as a standby to drive the rotary tumblers, in which case lighting would be obtained from the public supply, but neither service has yet been called upon.

For the past twelve years power required for the printing works of Edwin Snell & Co., Yeovil, has been obtained from a Petter 18-b.h.p. semi-Diesel engine. Last August a 16-b.h.p. Petter harmonic-induction engine was installed for driving by belt the main line shafting, to which is connected a dynamo (in addition to the printing machinery) for providing electricity to light both floors of the works, which have a combined area of 3,200 sq. ft. Over a period of six months the cost of fuel and lubricating oil has been £12 7s., whereas if the semi-Diesel engine had been used it would have been £28 3s. 4d. Two hours a week are sufficient for starting and stopping, replenishing with fuel and lubricating oil and cleaning, otherwise no attention is required. The engine was recently stripped for inspection, when the wear was found to be negligible.

The whole machinery, consisting of fourteen presses, guillotines, &c., is driven by the engine, with the exception of one automatic cylinder press which is driven by a 2-h.p. motor supplied from the public mains. During the period under review the cost of power for this single machine at 3d. per kWh was £15, running for less than half the time of the remaining machinery. The power-driven machines are three Wharfedale presses, demy, double demy, and quad-crown sizes, one No. 6 L. and M. Miehle press with auto feed, one Falcon and three platen machines and one linotype. In the binding department are ruling and folding machines and a 42-in. guillotine.

# Heating Costs. By R. W. Klitz, M.I.E.E.

## The case for electricity

THE economics of space heating turn first upon the cost of effective heat units actually applied to the air to be heated. With electricity the efficiency of application is 100 per cent., since the whole of the energy is dissipated in the form of heat, usually directly into the space to be heated. The specific heat of air is 0.238, so that to raise 1 lb. of air from 32 deg. F. (freezing point) to 60 deg. F. (a comfortable general room temperature) requires $28 \times 0.238 = 6.664$ B.th.u., and, as 1 B.th.u. = 0.293 Wh, the electrical consumption will be $0.293 \times 6.664 = 1.952$ Wh. As air weighs approximately 0.08 lb. per cu. ft., the loading is equal to 0.156 W per cu. ft.

Allowance must, however, be made for air changes if a healthy atmosphere is to be maintained, and a loading of 1 W per cu. ft. will maintain a temperature of 60 deg. F. when it is freezing outside with over six air changes per hour. Those may be looked upon as the most onerous conditions with an average minimum winter temperature of about 42 deg. F. An allowance of considerably less than this is adequate on most winter days and would represent good practice. Moreover, an installation can always be supplemented by additional plug-in fires during the coldest spells.

Full air changes are necessary only when the apartments are occupied, and with a not extravagant electrical loading the whole contained air is raised to a comfortable temperature in an hour or so. As soon as the inside air is warmed, it imparts heat to the walls and furniture, which soon represent a considerable amount of heat storage, while the rays of the sun also add their quota; so that after switching off the temperature will drop only about 1 deg. an hour to a minimum of 45 deg. F. or thereabouts in an occupied house.

In most houses and offices (but not in hospitals and such institutions) the electricity can be, and should be, entirely switched off at night and restored in the early morning. A time-switch is a necessity in such installations if due economy is to be attained. A notable exception to the night switching would be the normal thermal-storage system with automatic water mixing valve. With such systems it is usual to allow special low rates for the electricity consumed at night only and the time-switch then operates to cut off the supply during the daytime when the mixing valve takes charge.

### Comfortable Temperatures

Halls, passages, landings and sleeping apartments require to be kept at about 55 deg. F. A kitchen needs about the same, but with means to raise it a little after work is done if used as a sitting-room. In a dining room or drawing room comfortably heated by a coal fire the temperature in parts removed from the fire would be at about 60 deg. only. Full comfort in a sitting-room, study or office for sedentary occupations, calls for a temperature of about 65 deg. F. A drop to 60 deg. F. is just short of full comfort, except for young people, the elderly generally preferring a degree or two over 65 deg. F.

In a billiard room 60 deg. F. is enough. In a dance room this would be too much except for the "wallflowers," but the heating arrangement in such rooms is generally along the walls. A shop should be at about 55 deg., but the assistants will need 60 deg. in their own (behind-counter) space, as while customers are clad in outdoor wear the assistants are not. Fitting rooms will need 60 to 65 deg. F.

Real indoor comfort thus lies within a narrow band of 10 deg., and electricity with thermostatic control ensures this. Nevertheless the degree of indoor comfort obtaining in average households ranges, in really cold weather, from about 45 deg. F. only to 60 deg. F., or rather more on the side nearest to the fire. This is a consideration which must not be overlooked when comparing costs. For a greater comfort there must be greater cost, quite apart from any reference to alternative methods.

### Real Costs of Older Methods

Before entering on any comparison the real costs of the older methods of heating must be established. An open coal fire in a first-class grate yields an average thermal efficiency of hardly more than 5 per cent. throughout a season. That is to say, a good house coal having a calorific value of 14,000 B.th.u. per lb. will yield in average use about 700 B.th.u. per lb., equivalent to 466 kWh to the ton. If the coal costs £2 10s. per ton (over ¼d. per lb.) electricity may cost over 1.2d. per kWh, and show a further saving in eliminating labour, kindling wood, chimney sweeping and dirt.

With a good modern coal-burning kitchener used both for warming the kitchen and cooking a higher thermal efficiency may be expected when using a rather cheaper (harder) coal. With such coal at £2 per ton used at 10 per cent. efficiency (800 kWh to the ton) electricity (even considered merely as crude fuel) may cost 0.6d. per kWh.

If the kitchener is also used for water heating by means of a saddle boiler, a thermal efficiency of 15 per cent. can be attained (1,200 kWh to the ton) and electricity (in like comparison) may cost 0.4d. per kWh. With less efficient kitchen grates the case for the employment of electricity is even more favourable.

With a coke-fired boiler serving a central heating system it is possible in the coldest weather (the only period when the boiler is working near its full capacity) with continuous expert stoking to attain a thermal efficiency of 60 per cent., but under normal practical conditions the overall efficiency for a winter season of continuous use is rarely so high as 30 per cent. If there are long periods of banking or, alternatively, the boiler is sometimes let out overnight and re-ignited in the morning, the overall season efficiency will be of the order of 15 per cent., or, indeed, much less. In some churches and halls the boiler is in use only two or three times a week, when the effective thermal efficiency is of the order of 3 per cent.

Automatic stoking increases the thermal efficiency, but only at the expense of a power drive and more frequent and costly repairs, and as the fuel has to be fed to the hopper there is little saving in labour. It lends itself to a certain degree of thermostatic control which, however, is crude compared with the more flexible electrical medium.

[*Elliott & Fry.*

**Major Klitz is sales engineer to the Electricity Board for Northern Ireland**

We find, therefore, that coke having a calorific value of, say, 11,400 B.th.u. per lb., will yield in use only from about 342 to 3,420 of these, which is equivalent to from 224 to 2,240 kWh per ton. If the coke costs £1 10s. per ton, electricity (counted merely as crude fuel) may cost from 1.6d. to 0.16d. per kWh. The higher efficiencies are only attainable when accompanied by labour and maintenance costs and, except in very large installations, these would fully double the fuel cost, thus advancing the lowest relative figure from 0.16d. to 0.32d. per kWh.

Medium-sized installations are run at only about half that efficiency, say 1,200 kWh per ton of coke, which is equal to 0.3d. per kWh, or with 0.16d. added for labour and maintenance, 0.46d. per kWh.

Oil-fired plants have a rather higher efficiency but are certainly always more costly in this country than those using coke or coal. There are variations in the oil and its contained impurities to which the burners are very sensitive; they need skilled attention and frequent adjustments.

### Inherent Advantages of Electricity

There are outstanding advantages inherent in electricity quite apart from the obvious one of drudgery saving. With thermostatic control and an electrically wound time switch the electrical method is completely and reliably automatic, and will maintain predetermined temperatures within one per cent. at all seasons of the year without further thought or attention.

Regulation and control certainly has a most impressive, although at present an unassessed, value in favour of electricity. Coke-fired boiler installations have to be of sufficient capacity to deal with the coldest spells. The heating surface of the pipes and radiators is fixed and their working temperatures are only crudely adjustable by dampers at the boiler, leading to unhealthy overheating to which colds are more often due than to the absence of heating.

The gas industry has made a pretentious virtue of the necessity for ventilation where gas fires are used, but the effective calorific value of application is not more than 50 per cent., *i.e.*, a therm is about equal to 15 kWh. Some gas undertakings have calorific values as low as 3.8 therms per 1,000 cu. ft.

Apart from other considerations gas is ceasing to be competitive with electricity because it has touched bottom in price, whereas electricity will continue to fall in price as use increases.

# Oil Circuit-breaker Failures.

By "Arc Energy"

## Some of their aspects in relation to causes

COMPARED with the amount of switchgear in service the number of failures of oil circuit-breakers is very small. Yet the effects, psychological and material, of failure are such as to justify a review of some of their aspects in relation to the causes.

One or two major failures on a system are generally sufficient to cause disquiet in responsible quarters, although it is not many years ago that an engineer of a growing system informed me that he preferred to replace circuit-breakers only as they failed. However, after a particularly bad blow up, including the demolition of part of a building, that policy was changed. It is unlikely nowadays that such sins of omission are intentional and those that do occur may be attributed to lack of appreciation of the problem.

### Dealing with Old Switchgear

In order to secure as far as possible immunity from switch failure and its consequences, the first consideration is the older switchgear, the rating of which has come under suspicion on account of the growth of the system, interconnection of feeders and bulk supply arrangements, or indeed solely on account of age without these factors. Naturally, there will be a desire to retain as much existing switchgear as possible, and if an increase in kVA input under short-circuit conditions has materialised, limitation to something like the assigned ratings may sometimes be imposed by sectionalising and the use of reactors.

The problem, however, is not easily solved and a doubt arises as to the reliance that may be placed on these earlier circuit-breaker ratings. Prior to 1929, for instance, there was no British Standard Specification for oil circuit-breakers, and it was not until two years later that the first switchgear testing station was put into commission in this country. This does not mean that the design of switchgear previous to those dates was entirely by rule of thumb. Some manufacturers were able to have limited type tests made along with alternator tests, and, in addition, American testing facilities and experience were available. The valuable work of the Electrical Research Association on circuit-breaker performances was also at the disposal of its members.

Nevertheless, early ratings were, in general, higher than subsequent developments and research have proved to be possible, and the only course open to owners is to ask the makers of the gear for reassessment of its capacity. In this connection we must be clear on terminology. A circuit-breaker has both a making and a breaking capacity, and since in making or closing on to a fault the initial or peak current may be two and a half times the current broken under similar short-circuit conditions, it is evident that the former function imposes more severe stresses than does breaking—a point not always appreciated when speaking of "rupturing" capacity.

This is particularly relevant where a master switch is installed to control a group of switches of lesser rating, the protective gear being so arranged that the master switch trips first in the event of a short-circuit on any of the others. While the ability of any of the group of switches to withstand the electro-magnetic stress produced by the through fault current may have been ascertained it is important that there should be no possibility of closing it on to a fault, and this requires the provision of an interlocking system. The method, however, is generally undesirable, but has occasionally been adopted as an economic or temporary expedient.

### Associated Apparatus

The position concerning old-type switchgear is probably realised by most supply authorities and there is no doubt that a great deal of switchgear replacement has taken place of recent years and is at present in hand. To deal with the circuit-breaker alone may be a partial remedy only, unless the capacity of the associated conductors and apparatus are similarly reviewed in relation to the effect of short-circuit current. In the former case the stiffness of conductors and spacing and strength of supports would be material, and in the latter case the short-circuit factor of wound-primary current transformers may be particularly relevant.

The position as regards switchgear in industrial works does not appear to be so well realised by consumers, mainly because they are generally unaware of modifications and additions to the supply authority's system which may have resulted in an increase in the potential short-circuit kVA at their bus-bars, and there is, perhaps, some reluctance on the part of the supply authority to tell them. Consumers having sub-stations on their premises are specially affected, and they may feel aggrieved on discovering that some modifications may be necessary in the interests of safety and of continuity of supply. It should not be overlooked, however, that it is often the consumers' demand for more load that has brought about the changing conditions. If, for instance, it has been necessary to bring in another feeder or increase transformer capacity, it would hardly be fair to suggest that the supply authority should be solely responsible for any modifications to consumers' sub-station switchgear consequent on that change as affected by short-circuit kVA rating.

Reverting to circuit-breaker failures, the possibility of high tank pressures occurring affords perhaps the most food for thought, because of the serious consequences which may follow if the enclosure bursts. The condition is bound to appear if arcing persists under oil, even for a very short period, and experience shows that this need not be more than one second—and probably less. Determining factors in this respect are, first, the volume of oil converted into gas, proportional to the arc energy (kW seconds) and, secondly, the strength of the enclosure.

The gases given off by switch oil comprise hydrogen (about 70 per cent.), acetylene and a small quantity of ethylene and methane. While it is thought that the evolution of gas alone might be so rapid as to account for disruptive pressures, the ignition of the gas which is already compressed in the air space above the oil would obviously result in considerably higher pressures being attained. This superimposed pressure is, however, dependent on the right mixture of gas and air, so far as the hydrogen is concerned, and the most explosive mixture occurs when the proportions are approximately 30 per cent. hydrogen and 70 per cent. air. The possibility of a hydrogen-air explosion depends, therefore, to some extent on the volume of the air space in the oil tank.

### Behaviour of Acetylene

We do not seem, however, to know much about the behaviour of the acetylene content under the same conditions. Considerable investigation into the properties of pure acetylene has taken place in other directions. For instance, without air mixture acetylene can be exploded by means of a glowing platinum or wolfram wire under the following conditions:—

| Temperature of acetylene in deg. C. | Pressure in atmospheres at which explosion took place (gauge pressure). |
|---|---|
| 10 | 0.60 |
| 50 | 0.48 |
| 80 | 0.40 |
| 100 | 0.33 |
| 140 | 0.10 |

If the gas contains vapour the decomposition takes place at a higher pressure, but the explosion is more violent.

| Temperature of acetylene in deg. C. | Percentage of water vapour in gas. | Pressure in atm. at which explosion took place (gauge pressure). |
|---|---|---|
| 50 | 7.1 | 0.7 |
| 80 | 19.4 | 1.4 |

Pure acetylene under original pressures up to 9 atm. yields on explosion a pressure equal approximately to eleven times that of the original pressure. The propagation of a detonation wave causes the pressure to climb up to eighty times the original pressure. Experiments in heated tubes showed that the explosive decomposition occurred at 510 deg. C. at pressures of over 2.05 atm. and a velocity of 0.4 litres per min. With higher temperatures and velocity the pressure limit falls. The pressure necessary to decompose acetylene by adiabatic compression is approximately 170 atm. Acetylene-air mixtures are explosive between 2 and 70 per cent. of acetylene.

Uncontrolled arcing may be due to insulation failure (including breakdown of the dielectric strength of the oil), failure of the switch to clear the circuit when tripped, or in closing on to a fault, particularly with hand-operated gear. Prevention of failure of insulation or of the oil dielectric suggests routine inspection and tests as remedial measures in minimising the risk and need not to be enlarged upon here. One of the other causes, *i.e.*, overrated apparatus, has already been referred to.

A further type of failure is more disturbing because it is unexpected. Circuit-breakers have exploded when breaking much less than the rated maximum breaking-capacity kVA. even when the latter has been determined by short-circuit tests. Such failures have demonstrated what has been generally recognised for some time by manufacturers as one of the many problems associated with design, and tests at lower breaking capacities generally show a longer arcing time than at the optimum figure. It is, therefore, necessary to be assured of the performance of a circuit-breaker throughout its

range and not only at one point in it. The use of arc control devices should, as their name implies, effect an improvement, but the above remarks as regards arcing times would apply to those devices in which the pressure generated within the arcing chamber is utilised for the expulsion of the ionised gases, since the pressure is dependent on the arc energy or kVA interrupted. Incidentally, this appears to indicate that there must be a minimum limit to the size of circuit-breaker which may be fitted with such devices.

Closing on to a short-circuit imposes a heavy duty on a circuit-breaker and with hand-operated gear danger may result from hesitant operation. Operators should remember that, in addition to the compression of the kick-off spring, considerable opposing forces appear at the moment of contact due to electro-magnetic repulsion.

Where very heavy currents are involved the repelling force may make it difficult, if not impossible, to force the switch "home," and in such an event the pause in partial contact may result in chatter and arcing, overheating and welding at the contacts. The design of the latter is an important consideration in this respect. The period of contact is dependent upon the type of tripping mechanism and protective gear. If the former is of the "trip-free" type and the latter without time delay, release would be almost instantaneous and probably little or no damage would ensue. Since contact separation takes place before the switch is completely closed, the full effect of the kick-off springs is not obtained in such circumstances and the speed of break is likely to be reduced. As this is one of the factors affecting breaking capacity the result again depends on the reliability of the design.

Because of various physical limitations and some unknown factors it is apparent that the possibility of failure cannot be ignored, and some consideration is, therefore, necessary for protection against danger more especially in connection with personnel. Remote control suggests itself, and is in fact generally recommended for circuit-breakers above 150,000 kVA on account of the difficulty of closing by hand. There is, however, a large amount of direct hand-operated gear in use, that is, with no intervening wall or partition between the operator and the switchgear, and the recent introduction of spring reclosing devices affords a satisfactory and fairly economical means of securing protection for several types of circuit-breakers.

The device has the undoubted advantage that it is adaptable to existing gear and is self-contained. The spring is usually compressed by hand through a lever mechanism and released for closing the switch by means of a trigger or toggle, thus ensuring operation quickly without hesitation. A cord may be attached to the trigger, enabling the operator to stand outside the switch room or some distance away if necessary. In some respects this is a development of a more crude method adopted some years ago where the performance of the switchgear was in doubt, a rope being attached to the switch handle and passed through a ring cemented in the floor directly below the mechanism.

A more elaborate spring-closing mechanism available provides for automatic reclosure from one to three times. A further method, which requires an auxiliary supply for injecting low-voltage current, automatically prevents a circuit-breaker being closed if the circuit is faulty.

# Stage-lighting in Paris

THE completion of the electrical installation of the Paris Opera House, which has been undergoing a complete renovation, gives this theatre the most important stage-lighting installation in France. The sub-station is designed for a capacity of 1,800 kVA, with space for an eventual increase to 2,400 kVA. The two incoming cables from the nearby Trinité sub-station of the Paris Distribution Company can be connected to several feeders. Only one cable is normally in service, the other being a standby.

The system is two-phase and the circuit-breakers include 12,000-V, 400-A, 4-pole switches, with a small volume of water used for the extinction of the arc. Their rupturing capacity is 200,000 kVA and they are controlled by springs wound up by an electric motor, though for test they can be opened by hand.

Four transformer cells are provided in each of which a 12,000-V, 200-A, 4-pole section switch is installed, as well as four circuit-breakers. Each cell contains two 300-kVA, 12,000/57-V transformers capable of withstanding an overload of 20 per cent. for two hours or 100 per cent. for five minutes. The windings are immersed in "Pyranol" and their centre points are brought out and earthed.

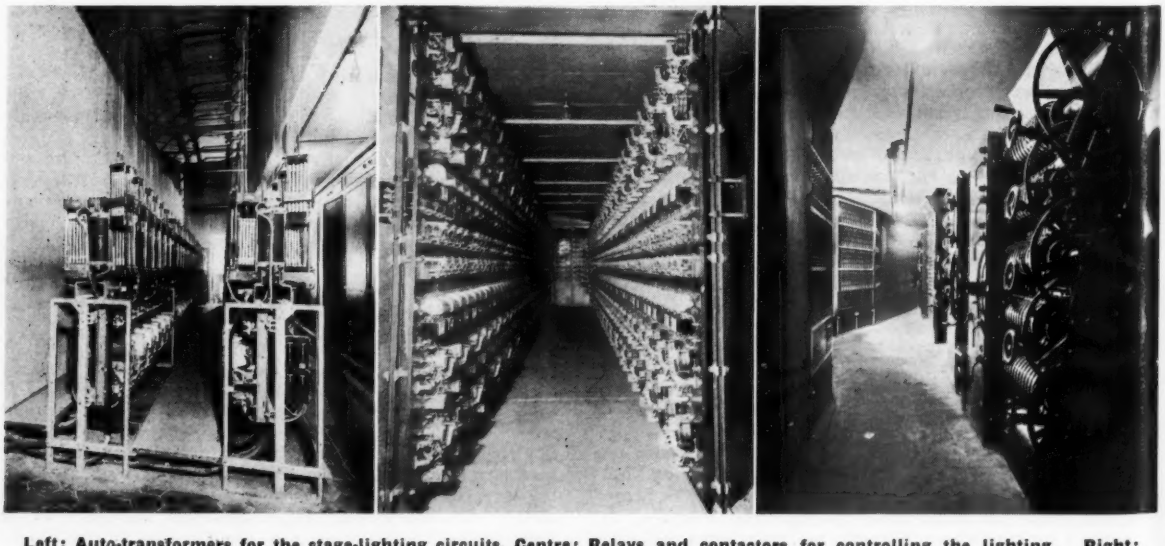
Automatic cut-over from one to the other of the feeder cables is provided for, while automatic coupling of the power transformers is effected by relays and permits only such transformers as are actually needed to be left in service, reducing no-load loss, which amounts to 970 W for each of the six transformers.

The considerable amount of stage-lighting equipment may be divided roughly into two groups, one comprising footlights and striplights and the other comprising floodlights, spots and clusters. The footlights are in a double row, one above the other, and are provided with 200-W lamps; ten strips have lamps of the same size. Apart from these there are 72 floodlights of from 1,000 to 1,500 W each on flying bridges and 22 large floods containing three 1,000-W lamps, each also on flying bridges, for lighting from above. Each of the large floods is provided with a four-colour screen controlled by electric motors, one set of which is placed on the flood bridge and the other in the main switchboard room. The motors are of the asynchronous type and the rotor rings are connected together so that any angular displacement of one motor will be immediately reproduced by the other. There are also 11 mercury-vapour-lamp floods with screens controlled on the same system.

There are 96 portable floods of from 1,000 to 1,500 W each, 30 spotlights of 3,000 W at 115 V and 18 of 3,000 W at 65 V. These can be plugged into sockets provided in profusion both on the stage and on the flying bridges as well as around the frame of the stage and in the auditorium.

The control of the lighting is exercised from the main switchboard room under the stage apron. There are two sets of levers, one being for the control of the footlight and striplight group and the other for the floodlight and spotlight group. The levers actuate wires which move the sliders of auto-transformers, which are placed in a separate room.

As there are some 300 lighting circuits to be controlled from the switchboard, it was considered advisable in order to facilitate the work of the electricians to install a separate switchboard which would permit of the setting up of a certain number of effects in advance. Four preparations can be arranged, which, by proper coupling, can be increased. Some idea of the complexity of the installation may be had from the fact that over 310 miles of wires and cables are used.



**Left: Auto-transformers for the stage-lighting circuits. Centre: Relays and contactors for controlling the lighting. Right: The main switchboard**

# Domestic Electrical Progress Overseas.

## By Viola Ripley, B.Sc.

Mrs. Ripley, the author of this article, has just returned to England after a world tour

THE following notes are based on the experiences of a world tour including several weeks in Canada, the United States, Malaya and Mombasa, and periods of a few days at a great many other places. My first stay of any duration was at Toronto, where I was fortunate in seeing the Toronto Exhibition, where there was a comprehensive display of electrical apparatus. It seems clear that the big sale of the larger domestic appliances such as washing machines and ironers has only been possible because the Canadian house has a big basement provided for the central heating apparatus, which gives adequate space for the use of these machines. Electrically driven, thermostatically controlled automatic stokers for central heating plants are gaining ground.

Air conditioning of restaurants and smaller public buildings is fairly common, in addition to the usual air conditioning of cinemas. Thermostatic control for cookers is now accepted practice and this, with air conditioning, is even more common in the Middle Western and Western parts of the United States which I visited. In Los Angeles almost every restaurant and many flats are air conditioned.

So-called "Thrift" cookers, well lagged and provided with simmering heaters of 100 W to 150 W and sometimes with an additional boiling winding are meeting with considerable demand. They seem to be particularly popular in holiday centres, owing to the safety with which the housewife can leave food cooking while she is out of doors. From what I saw it seems that central heating and similar systems of electric heating will make more progress in England when associated with air conditioning.

Manila is the only town with any considerable market in the Philippine Islands and here air conditioning is just beginning to make progress. A block of air conditioned flats, just built, were all let immediately. In this particular building, each flat is divided into day and night quarters, arranged so that either half can be air conditioned, so reducing the load on the central plant. There is a great demand for fans of all kinds.

The market is very similar in Hong Kong. In both places the de-humidifying effect of air-cooling plants is an important sales point. While refrigerators are used universally the demand for washing and ironing machines is very small owing to the cheapness and efficiency of native labour.

In Japan, over 90 per cent. of the houses are wired for light, largely owing to the lack of any other lighting medium and the cheapness with which wiring can be installed in the typical wood-framed Japanese house. Mains radio sets have been sold in considerable quantities, but up to the present the sale of other appliances has not made much progress. This is largely due to the fact that, although the prices of appliances are low, the wages and salaries are even lower in proportion and the price per unit is usually high because the plants were designed in the first place for lighting only. Where suitable supplies are available, electric heating should make good progress, as only very recently built houses have any flues and the usual method of heating is by a portable charcoal brazier.

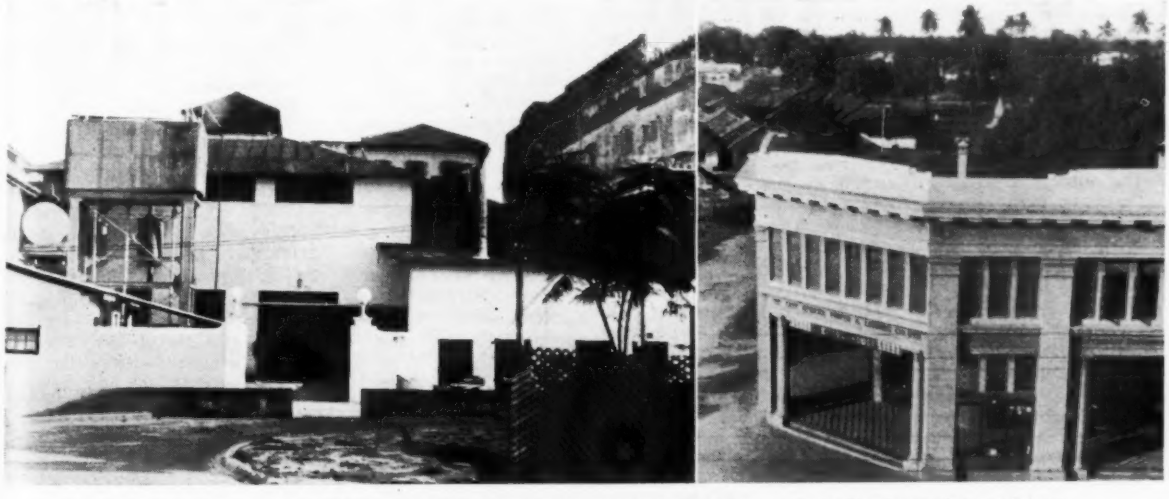
In Java, all kinds of electrical apparatus are used, although the Dutch population is not so highly paid as the British residents are in neighbouring countries. A very large amount of the business is in the hands of Chinese and whilst they are often content with a comparatively low standard of life, they are beginning to appreciate modern comforts and their demand forms a considerable portion of the whole.

Chinese form 42 per cent. of the population of Malaya. They are probably the most important market. The short terms of engagement for which Europeans go out there make them reluctant to spend anything beyond what is absolutely necessary on household appliances. Development in some country districts is hampered because power is supplied during the night hours only. It was interesting to find thermal storage cookers in use in ancient buildings in Malacca and I was informed that the Chinese servants quickly learn to use this kind of apparatus. The sale of other labour-saving devices is limited, as in other parts of the East, by the cheapness of native labour. Air conditioning has hardly been heard of; the only air-conditioned restaurant in Singapore was Austrian.

In East Africa, the climate makes refrigerators a necessity and the machines stand up well to the climate. Fans, kettles and irons are popular. Native labour is too cheap for washing machines to have much sale, but the sale of cookers is increasing, encouraged by a recent cooking exhibition at Nairobi. The large Indian population eats only stewed or fried food, consequently only hotplates are bought by the Indians, except the wealthiest who have adopted European ways. Air conditioning has not yet become popular, even on the coast. No electrical goods are manufactured and there is a definite preference for British made imported goods. The introduction of a reasonable tariff, a charge of 3s. per room per month and 7½ cents (nine-tenths of a penny) per unit, will lead to increased use of electrical appliances.

In Portuguese East Africa most of the supplies are direct current and are subject to considerable voltage variations. The price of electricity is very high and consequently very few domestic appliances are in use. This applies even to refrigerators, which otherwise should meet with a ready sale. As in most tropical countries, the interference caused by the numerous fans spoils radio reception to a very large extent.

In British South Africa cheap native labour has restricted the sale of the more expensive domestic appliances, but much could probably be done by encouraging the use of these in the home, instead of, for example, allowing the natives to take away clothes for laundering, often under unhygienic conditions. According to figures that I saw in Cape Town, electric cookers are making considerable advances and the electricity supply authority is pursuing a very progressive policy; for example, in September, 1930, there were 1,051 electric cookers in use, while at the end of January, 1937, there were 19,488. There is considerable interest in air conditioning both in Durban and in Cape Town.



The power station at Zanzibar, and (right) the electricity offices and showroom at Mombasa, Kenya Colony

# Vectors in A.C. Work

## By G. W. Stubbings, B.Sc., A.M.I.E.E.

THE algebraic representation of a vector, or directed quantity, by such an expression as $x+jy$ gives rise to no difficulties as long as $j$ is merely regarded as a label indicating that the $y$ length is measured in a direction perpendicular to that of $x$. The polar form of a vector $R(\cos\theta+j\sin\theta)$ is also easily accepted. Further, the addition of vectors expressed algebraically is quite simple, since all the $x$ quantities are collected and added, as are the $y$ quantities which bear the special label $j$.

The mere algebraic representation of the addition and subtraction of vectors would, however, be of little use in a.c. calculations, and the whole object of the vector calculus is the

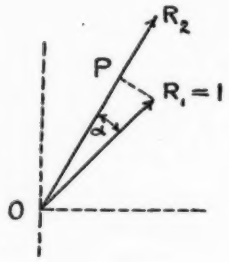



Fig. 1

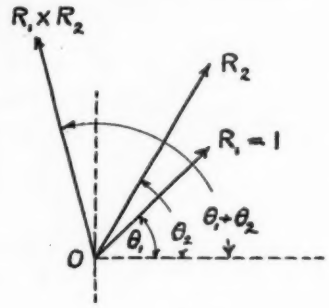



Fig. 2

dealing with currents, voltages and impedances, in which the processes of vector multiplication and division are inherent.

It is in connection with vector multiplication that the identification of $j$ with the square root of minus one arises. According to the popular explanation when a vector $+1$ is multiplied by a second vector $-1$ the result is to turn the $+1$ through 180 deg., so that the result is $-1$. From this it is generally supposed to be self-evident that if the turning be stopped half-way and then started again the process of multiplication is divided into two steps which are symbolically represented by $j\times j$ and that, as these two steps give the same result as multiplication by $-1$, it follows that $j\times j=-1$.

But why, it may be asked, may we assume that a change of sign of a vector is a turning operation that can be stopped halfway? This is the whole question, which is usually taken for granted.

The multiplication of two vectors or directed quantities is an operation which is really meaningless, and if it is required in mathematics, some conventional meaning must be given to it. In fig. 1, if $R_1$ is the vector of a force which overcomes a resistance and effects a displacement represented in direction and magnitude by $R_2$, then one interpretation of a vector product is the work done by the force, which is equal in magnitude to the projection OP of $R_1$ on $R_2$, multiplied by $R_2$. This product of the two vectors is a scalar and has no direction. A second interpretation of a vector product is $R_2\times R_1P$ or $R_1R_2\sin\alpha$, the direction assigned to this product being at right angles to the plant containing $R_1$ and $R_2$. These kinds of vector products are used in applied mathematics, but they have nothing to do with the imaginary $j$.

The philosophy of vector multiplication is contained in the statement that we can assign any interpretation we like to the product of two vectors provided that our interpretation leads to consistent results. An interpretation alternative to those mentioned above is comprised in the following rule: The product of two vectors $R_1$ and $R_2$ which have directions $\theta_1$ and $\theta_2$ respectively to a reference line is a third vector whose magnitude is $R_1R_2$ and whose angular inclination to the reference line is $\theta_1+\theta_2$ (Fig. 2). This convention will work if the product $j\times j$ is always put equal to $-1$ (see Whitehead's "Introduction to Mathematics") and the rule is justified by the consistency of its results. As the interpretation of a vector product is not unique, it cannot be proved, any more than can the rule of signs in algebra. Thus the "equation" $j^2=-1$ depends merely upon a convention for the interpretation of a vector product, and this is the sole justification for identifying $j$ with the square root of minus one.

It is shown in text books on algebra that the expression $R(\cos\theta+j\sin\theta)$ can be converted to the form $Re^{j\theta}$, whence $e^{j\pi}=-1$. Algebraically the latter expression is of extreme complexity. Interpreted vectorially it simply states the platitude that rotation of a vector $+1$ through $\pi$, or 180 deg. reverses its sign and converts it into the vector $-1$.

Vector multiplication is needed when alternating currents have to be calculated from voltage and impedance values. A difficulty which is generally passed over in explanations of the symbolic notation is that of treating an impedance as a vector. Now, *prima facie*, an impedance is a quantity depending upon physical constants and frequency, and it is essentially devoid of any property of direction. Yet in a.c. calculations a reactive impedance X must be expressed algebraically as $jX$, *i.e.*, as a vector leading in phase on a reference by 90 deg. As an inductive impedance suggests a lag in phase, this sometimes causes the vector calculus to be used mechanically without real understanding.

It seems better to consider the vector $jX$ to be of a voltage or potential difference set up in the impedance X by a current expressed as a unit real vector. Thus for any current expressed by the vector I the voltage drop in the impedance V will be $I\times jX$, so that $I=V/jX$. Since $j^2=-1$, this is algebraically the same as $I=-jV/X$, which expresses correctly the rule that the current in a reactance lags behind the applied voltage by 90 deg., since $-j$ indicates a lag in phase. A consideration such as this avoids the artificial conception that an impedance is a vector quantity, the sense of which is opposite from that which it is instinctively felt to be, *i.e.*, that of the current flowing in it.

## Electrical Uses of Platinum

PLATINUM and its six allied metals are the subject of a paper by Messrs. C. Johnson and R. H. Atkinson (Mond Nickel Co., Ltd.) which was read before the Institution of Chemical Engineers in London on May 19th.

The paper shows the amounts of platinum produced in various countries, and outlines the order of operations and plant employed at the Acton refinery of the Mond Nickel Co. Electrolytic refining cannot be employed because palladium is the only member of the group that dissolves easily anodically in an aqueous electrolyte.

Among the uses to which these metals are put the authors mention electrical contacts, standard resistances, electrodes, &c. Platinum anodes are used in the chemical manufacture of per-acids and per-salts. When greater resistance to electrolytic action is desirable, rhodium and iridium may be worth considering. Platinum and rhodium resistors for electric furnaces will operate at temperatures as high as 1,500 deg. C., particularly if oxidising atmospheres are present. Palladium is used in considerable amounts for contacts and relays in telegraph and telephone work.

Several metals of this group have been employed in the making of incandescent electric lamps, but to-day platinum lead-in wires are used only for heavy currents; for example, motor car head lamps, and somewhat similarly for the filaments of radio amplifying valves. A recent application in the lamp industry of a 10 per cent. rhodio-platinum alloy, due to its resistance to corrosion and abrasion at high temperatures, has been for glass feeding nozzles in machines for casting lamp bases. It is claimed that a lining of this alloy increases the life of dies by 190 times. Iridio-platinum contacts are used for aircraft magnetos.

The Southgate Town Hall, one of the buildings in its area floodlighted by the Northmet Co. [*Elec. Rev.* photo.

# Laminated Synthetic Resin. By A. E. Williams

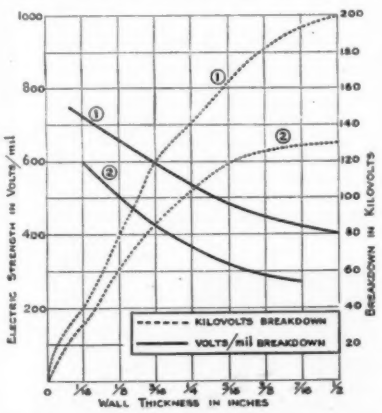
## Recent insulation developments

ALTHOUGH several types of synthetic resins are now manufactured on a commercial scale, those produced from phenol-formaldehyde generally have the best insulation value. In the electrical industry these resins are applied, broadly, in two chief forms (*a*) varnish for the coating of paper and fabric insulation, impregnating windings, or as a binder in cable manufactures, and (*b*) as a bonding material in making laminated insulation. For insulating varnish the phenol-formaldehyde has the highest resistance to the action of heat and of oils, but when resistance to chemical corrosion is necessary a resin made from acetaldehyde is often preferred, and this type has the best insulation properties when it has been prepared in an alkaline medium, not an acid mixture. Such a resin also has the best resistance to chemical attack, including strong caustic soda and mineral acids.

### Dielectric Strength

In many cases it is found that the synthetic resins are not only cheaper than shellac, or other natural varnish, but that they possess a higher dielectric strength. Comparative tests show that on coated paper the dielectric strength of the synthetic materials is from 10 to 20 per cent. greater than that of natural varnishes. To obtain this good insulation value the resins must not contain any trace of the electrolytic chemicals used in their production. For this reason, resins intended for insulation purposes are invariably put through special purifying processes to eliminate these impurities. The solvent in which the resin is dissolved to make an insulating varnish must leave no residue on evaporation, and should preferably form a quick-drying film. Recently, new hydrogenated solvents have been introduced which induce greater solubility of the synthetic resin than either turpentine or linseed oil. A typical example of these new solvents is a mixture of equal parts of hexaline and decaline.

A disadvantage of these hydrogenated solvents is that their flash-point is often as low as 65 deg. C., and in the majority of cases this renders them unsuitable for use alone. Much time and trouble may be saved, however, by first dissolving the resin in these solvents until a saturated solution is obtained and then thinning down with linseed oil. As the hydrogenated solvents dissolve from 5 to 10 times as much resin as an equal volume of either linseed oil or turpentine, they afford an economical method of bringing the resin into solution. A varnish prepared in this manner dries within an hour or so, and this drying period may be shortened by using driers, but often at the expense of the insulating value.




**Electrical properties of two forms of tubular "Formapex Miocarta" insulation. No. 1 is for use in e.h.v. apparatus and No. 2 is suitable for h.v.**

Laminated insulating materials are produced in rectangular sheets of about 2 ft. by 4 ft., and in thicknesses of from a fraction of an inch to several inches; also in the forms of rods and tubes. The basic material may be paper, fabric, or asbestos. Sheets of the basic material are first coated with the synthetic resin varnish, then a number of the coated sheets are superimposed one on the other and compressed by hydraulic power into a hard and compact homogeneous sheet or block. A tube of this material is made by wrapping the varnish-coated base around a hollow steel core, through which steam is passed to harden the resin, this being simultaneously subjected to pressure.

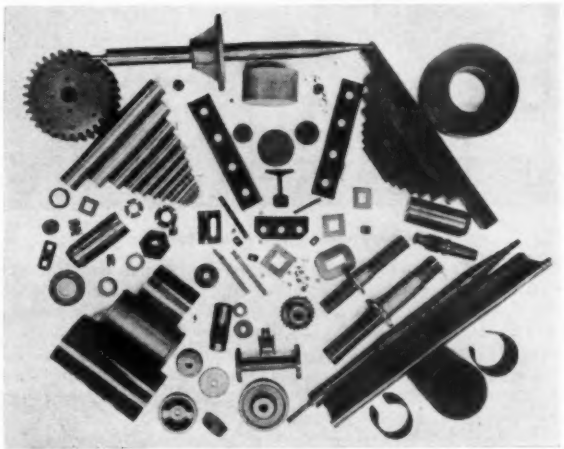
In this class of insulation the properties of the completed product vary according to the base used. In general, paper gives the highest dielectric strength, fabric imparts rather lower insulating value but has good mechanical strength, while asbestos possesses only a moderate dielectric strength but is most suitable for high-temperature work. These varying properties are illustrated in the accompanying table, which refers to laminated insulation manufactured by the Ioco Rubber & Waterproofing Co., Ltd., under the name of "Formapex Miocarta."

The paper used for laminated insulation must be carefully selected and be as dry as possible. All paper normally contains from 5 to 12 per cent. moisture, and this has to be practically entirely removed before impregnation. Dry paper, varying in thickness from 2 to 30 mils, without impregnation, has a dielectric strength of between 130 and 250 volts per mil and the object of impregnation is to maintain this high resistivity by preventing moisture absorption, and, if possible, to increase it through resinous impregnation. The ultimate mechanical strength of the paper and products made from it depends on the basic raw material of the paper.

| Nature of Test. | Paper. | Fabric. | Asbestos. |
|---|---|---|---|
| Electric strength (minute value) volts/mil on ¼in. sheet ... ... | 200 | 50–75 | 25–50 |
| Tensile strength (lb. per sq. in.) ... | 15,000–20,000 | 14,000–16,000 | 9,000 |
| Compression strength (lb./sq. in.) at right angles to laminae ... ... | 44,000–46,000 | 40,000 | 30,000 |

The electric strength is tested at 90 deg. C. in the cases of paper and asbestos bases, and at 30 deg. C. for the fabric.

For electrical work it is usually specially selected and then purified by chemical treatment to eliminate electrolytes. In general, linen or manila fibre imparts the best mechanical strength to the paper, wood-pulp paper being much inferior in mechanical strength. The size of the fibres used has an important bearing on the machining properties of the finished insulation, *e.g.*, for intricate machining very small fibres are desirable so as to preserve a homogeneous whole between resin and base. The accompanying curves show the electrical properties of two forms of tubular "Formapex Miocarta" insulation. No. 1 is for use in extra-high-voltage apparatus, such as switchgear, transformers, &c., and can be used in service at temperatures up to 120 deg. C., or up to 150 deg. C. for short periods. No. 2 is also suitable for high-voltage work, but at somewhat lower temperatures than No. 1; it is especially suitable for intricate machining, and can be drilled, tapped, threaded, tapered, &c.



**Electrical machinery parts made from synthetic material**

On account of the good mechanical strength which it possesses, combined with high dielectric strength, modern laminated insulation is being increasingly employed in the electrical industry to lessen risk of current leakage for component parts of starters, switchgear, &c., for which purposes metal has hitherto been exclusively used.

## The I.E.S. Widens its Scope

By the formation of new sections catering for the needs of those whose interest lies in certain special phases of lighting, the Illuminating Engineering Society hopes considerably to widen its scope. The first of these new sections, devoted to photometry, was formed during the previous session, and a second section, concerned with industrial lighting, under the chairmanship of Mr. R. O. Ackerley, has now been formed and has already held several meetings. A third section, to be devoted to public service lighting (including street lighting), under the chairmanship of Mr. A. W. Beuttell, is also in course of formation and will commence regular meetings in the autumn. This section, whilst specially interested in street lighting, includes within its scope other allied lighting problems, such as lighting of public gardens, garages and parking grounds, public buildings, &c. A fourth section, dealing with decorative lighting, is now being considered.

# Correspondence

*Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication*

### Private Coronation Floodlightng

At the time of the Jubilee you published a photograph of my house floodlighted for the occasion.

The Coronation celebrations have provided me with an opportunity to improve on the original scheme. The front of the house is lighted by a battery of three 150-W lamps, with

**A floodlighted house at Esher**

suitable reflectors mounted on adjustable stands constructed from 5-ply wood; an amber effect has been obtained by the use of car fog discs. A flag-pole in the background is picked up by the white beam of a 150-W projector.

Supply has been taken from the main consumer's switch and separately fused with an outside control switch and distribution point camouflaged to tone with the surrounding garden.

The accompanying photograph gives an idea of the results obtained.

JOHN A. JEFFREY.

Esher, *May 10th.*

### Guarding Against Arrears

Referring to the article in your issue of May 7th entitled "Time Controlled Step-rate Meter," it would appear that this meter has been designed with one object, namely, to prevent the consumer from running into arrears. I consider that the question of arrears as associated with two-part tariff meters is a bogy which is not worth worrying about as the following figures prove.

The undertaking with which I am associated has used the two-part tariff multi-coin meter since its inception in 1933. At the end of 1936 we had 2,700 meters of this type in circuit. The number of consumers in arrears with this type of meter was ten, or 0.37 per cent. In each case of arrears there was a definite reason: for instance, one house was closed for thirteen weeks, the occupier being in hospital. In another case the tenants were away from home due to illness, and so on. No difficulty was experienced in collecting the arrears, the weekly fixed charge being slightly increased until the arrears were paid.

F. C. W. CLARK,
*Technical Assistant.*

Hamilton, *May 17th.*

### Static Electricity

I have read with interest the letters in your recent issues regarding static electricity.

It is quite a common thing to generate electricity through walking on a carpeted floor, provided the atmospheric conditions are suitable. These conditions are best obtained in dry frosty or warm dry sunny weather. I have spent several years in America and have found that static electricity is more easily generated at high altitudes than at sea level, due mainly to the rarefied atmosphere under the former conditions.

Mr. Spurr doubts whether friction is actually the cause of static electricity, but I would point out the salient fact that friction is responsible for the static phenomena under review, *i.e.*, is the exciting medium, as otherwise no static would be generated. The friction may be due either to rubbing or separating the bodies, and on separation the charge is naturally distributed between the two bodies according to their size and resistance. Mr. Spurr's suggestion of overcoming the charge in a modern flat by spraying the carpet with deliquescent salt, such as calcium chloride, seems to indicate that he is not a married man.

R. M. F.

Stevenston, Ayrshire, *May 11th.*

### Price Reductions Bring Business

Presumably Mr. Bullen's letter in your issue of May 7th was written to encourage the more conservative undertakings to reduce their charges. Whilst most of these undertakings doubtless realise that to reduce domestic charges benefits a certain section of their consumers, the more enlightened ones feel that a very low domestic follow-on rate such as 0.48d. per unit may have a serious reaction on their financial stability and thus reduce the possibility of serving the more remote and "leaner" parts of their areas of supply.

Mr. Bullen's figures seem to bear out this contention and to be a warning to all those who may be contemplating a course of action similar to that taken by the Welwyn undertaking last July. To avoid complication I am setting out below the relevant figures for the ordinary meter consumers only:—

| Quarter. | Units taken. | Pence per unit (follow-on rate). | Revenue. |
|---|---|---|---|
| March, 1936 ... ... ... | 656,549 | 1d. | £2,740 |
| March, 1937 ... ... ... | 882,528 | .48d. | £1,760 |
| Difference ... ... | (+) 225,979 | | (−) £980 |
| Additional cost of bulk supply units @ .21d. + coal @ 2/6 inc. + 10% for losses ... ... ... ... ... ... ... | | | £240 |
| Total ... ... ... ... ... ... | | | £1,220 |

The above figures exclude fixed charges, but these do not appear to have been increased. In addition to the loss of £1,220 it is very probable that the demand has increased and it would be extremely valuable to know the relative demands (excluding all power consumers) for the two quarters.

R. B. ROWSON.

London, S.W.4, *May 10th.*

## St. Pancras Church Floodlighting

AMONG the many examples of architecture displayed by floodlighting during the Coronation celebrations, that of St. Pancras Church, London, is particularly striking. The lighting installation was designed by Crompton Parkinson, Ltd., in conjunction with Mr. Robert Lee, A.M.I.E.E., of the St. Pancras Electricity Department. The tower, as can be seen from the accompanying illustration, is brilliantly lighted, and provides a landmark at night for a considerable distance. Sixteen 1,000-W concentrated floodlights are distributed round the tower, two batches of four being situated in the eastern extremities of the church roof and a further two batches on the roof of a neighbouring building facing the west end. This arrangement provides a very evenly distributed light over the tower. The north side of the church is lighted by nine wide-angle 1,000-W floods, and the front portico is covered by eight projectors of the same type and wattage. The effect of the light on this portico is particularly pleasing. The pillars are thrown up in sharp relief as silhouettes against the flood-lighted doorway. The latter is an

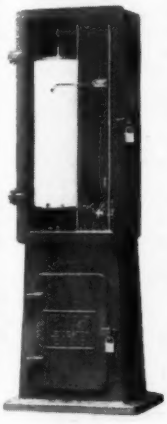
**St. Pancras Church floodlighted**

extremely good subject for floodlighting, having a fine decorative treatment on the stone surrounding the doorway.

# New Apparatus and Devices

## *for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes*

### Measuring Liquid Levels



The "Tangent" liquid level indicator

GENT & CO., LTD., Faraday Works, Leicester, have sent us particulars of a new type of "Tangent" liquid-level indicator, three of which they have designed for use in a tropical country. The variation in height of the liquid to be recorded on the chart was 40 ft., and indicators at 1 in. to the ft. were called for, but limitations of space available on site did not permit of this. The barrel and chart were only 20 in. long, but each chart was provided with two pens, mounted side by side, marking in different colours and they were coupled by a differential mechanism without time lag between them.

As soon as the first pen had traversed its maximum distance of 20 in. (=20 ft.), the second began to travel upwards, thereby doubling the range of the chart. The three instruments were mounted on cast-metal pedestals within which were a sprocket wheel, chain, float and counter weight, the floats being designed for working in a 14-in. stand-pipe.

### Oven and Water-heater Thermostats

Two new thermostats have been developed by "DIAMOND H" SWITCHES, LTD., Gunnersbury Avenue, London, W.4. One is designed for oven use. The accompanying illustration shows the unit with the fibre washer, one-hole fixing bush and the pointer handle laid out separately. Another type of dial has a black handle double-ended with a chromium-plated insert, the dial itself being moulded of a translucent material so that when a pilot light is used behind it the temperature settings are illuminated.

The thermostat is the same size as the three-heat cooker switch. It has the same methods of fixing and does not require a larger hole in the panel. For some makes two small slots have to be filed in the front hole in the panel to allow the double-ended handle hook to pass through; this can be done without much trouble in a few minutes on the job.

Sensitivity depends on the position of the active bulb in the oven, a control with a maximum spread plus or minus of 7½ to 10 deg. F., and in some cases 5 deg., being possible.

The water-heater thermostat is of similar design.

### A Portable A.c. Test Set

The "Weameter" test set of ELLIOTT BROTHERS (LONDON), LTD., Century Works, Lewisham, London, S.E.13, is a portable a.c. instrument with a single movement and of B.S.S. 89 "first-grade" accuracy. The indicator is of the iron-cored dynamometer type and is capable of measuring wattage, amperage and voltage with the aid of a current transformer, which is variously inter-connected, as needed, with the field and moving coils of the instrument by means of a simple three-way switch.

The "Weameter" test set

The total weight of the outfit with two "Mumetal" current transformers is only 9 lb. One of the transformers is of the miniature multi-range type and can be accommodated inside the lid of the case, which is of small dimensions. Its smallness is made possible by minimising the burden on the current side, *i.e.*, from 0.7 to 1.2 VA. On the 2.5-A range there is not more than 1-V fall. The instrument is not quite non-inductive on the voltage side. Iron loss in the field magnet causes a small phase displacement between the exciting current and the flux in the air gap. This small lagging angle is practically constant relative to load variations, but might cause inaccuracy when the circuit power factor is low. A small compensating inductance is, therefore, introduced into the voltage circuit. It would be inconvenient to change this compensation for each range and to avoid the necessity of this the auto-transformer method is used instead.

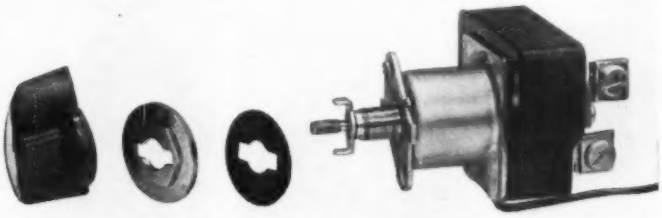
### A Domestic Humidifier

To humidify dry air to the degree best suited to the respiratory system a simple apparatus, intended particularly for domestic or office use, is being marketed by the A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, Westminster, S.W.1. Inside the neat metal cabinet absorbent paper pads become saturated with water from a container at the base of the unit, the evaporation being accelerated by an electric fan. With a relative air humidity of 50 per cent. and a temperature of 68 deg. F., the apparatus is capable of evaporating approximately 7 oz. of water per hour.

A humidifier for the home

### Tubular Condensers

Tubular-type condensers, manufactured under the trade name "Breco," are being made by BRENTFORD TRANSFORMERS, LTD., 234A, High Street, Brentford, Middlesex. They are made in all capacities from 0.003 to 1 mfd. and every turn of the electrode windings is metallically soldered to the connecting leads.



The new "Diamond H" oven thermostat

The condenser is enclosed in a specially prepared bakelite wrapping with no air space between the outer wrapping and is subjected to a heat process that solidifies the wrapping under vacuum before further impregnation takes place. It is claimed that this ensures the condenser against ill-effects from exposure to atmospheric influence for exceptionally long periods.

The company makes power-factor condensers and models for interference suppressors as well as mica dielectric types of very small dimensions for given capacities.

### A "Coronation" Iron

The "Coronation" iron is a new low-priced model just introduced by BRITISH NATIONAL ELECTRICS, LTD., Motherwell, Lanarkshire. A thumb rest is provided, and the heel allows the iron to be rested in a vertical position. The iron is fitted with 6 ft. of flex with an adaptor and a specially moulded side entry connector and supporting sleeve. As an alternative "extra" shrouded terminal pins and three-core flex can be obtained. The loading is 500 W. and the weight 5 lb., both nickel plate and chromium plate finishes being available.

The "Coronation" iron

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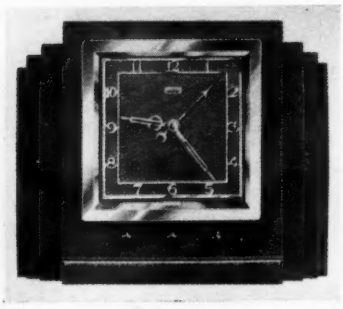
## Combined Clock and Radio Receiver

An interesting new product by RADIOCHRON, LTD , Oaklands Works, Oaklands Road, London, N.W.2, is a combined electric clock and radio receiver.



The "Radiochron" clock-receiver

The outfit is little larger than a clock, which forms the bulk of the face and the whole of the loudspeaker opening, but comprises in addition a five-valve superheterodyne receiver employing all-metal valves, a moving-coil loudspeaker, a built-in aerial, a.v.c. and interference suppression.

The dimensions of this compact little combination are 10 in. high by 12 in. wide by 4 in. deep.

## Secondary-emission Photo-cells

Secondary-emission photo-cells are claimed to combine the good points of both vacuum and gasfilled cells without the disadvantages of either.

In addition to high sensitivity, the absence of gas-filling ensures low noise level and a good frequency characteristic to interrupted light. Consequently they are admirably suited to television transmission and acoustic reproduction from film as well as to industrial applications.

The glass envelope of Type C.W.S.24, made by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, is evacuated and the primary emission from the cathode impinges on another cathode (target) from which secondary electrons are ejected by the impacts of the primaries. Each primary sets free several secondaries, so that a magnification of the primary current is secured and the secondary emission finally reaches a collector adjacent to the target, which performs the same function as the anode in the ordinary photo-cell.

The collector is maintained positive with respect to the primary cathode. The secondary cathode (target) is also positive with respect to the primary cathode, but negative with respect to the collector. It is recommended that the potential difference between the primary and secondary cathodes be 75 per cent. of that between primary cathode and collector. The total voltage between primary cathode and collector (anode) may be anything up to 800 V.

A safety resistance of 10,000 ohms should be inserted between the source of potential and the secondary cathode and the load resistance between the source of potential and the collector.

The primary cathode is formed on the silver surface which is deposited on one-half of the internal surface of the spherical bulb. The secondary cathode (target) is formed on a silver tube that is supported in the middle of the bulb. The collector (anode) is also supported at the centre of the bulb and consists of a molybdenum spiral coaxial with and surrounding the secondary cathode.

Both primary and secondary cathodes are of the caesium-on-silver-oxide type. The collector and secondary cathode are mounted on separate pinches in order to reduce the capacity of the collector to a minimum. The primary cathode is connected to the grid pin of the valve base, the secondary cathode to the anode pin and the collector to a screw cap at the top of the bulb.

Primary emission (after a preliminary ageing period during which it rises steadily) is of the order of 40 $\mu$A per lumen, and the secondary-emission coefficient (defined as the ratio between the number of secondary electrons emitted from the target in unit time and the number of primary electrons hitting the target in the same time) rises to seven for 250-V primary electrons.

## Some New Lighting Fittings

A selection of new lighting fittings:—1, 3 and 5: Dernier & Hamlyn, Ltd.; 2 and 8: Oswald Hollman; 4: Eca-Ray Sales, Ltd.; 6: Troughton & Young "Louverlux"; 7 and 9: Novonotions, Ltd.

# The Multiplicity of Tariffs. By F. R. Jervis

## What is the true position?

OF the many present-day criticisms of electricity tariffs the one which is probably the most widespread is that electricity supply undertakings offer their commodity for sale under bewilderingly complex lists of tariffs. Popular newspapers which occasionally enter the arena to reform the electricity supply industry make much capital out of this.

It is often complained that there are six hundred-odd different undertakings in the British Isles and each has its own method of charging. I have seen it stated that there are over 1,000 different tariffs in the country; but what constitutes a "different tariff" was not clearly shown. It is interesting to determine just how much the charge of excessive multiplicity can be justified.

In the first place, domestic tariffs only will be considered. The reformers are not interested in commercial or industrial rates, which often present a considerable element of contract or bargaining, and, moreover, the form of those tariffs is of less importance than the size of the bill or the average price charged. As the domestic consumers are the largest class, it is necessary to study more the form of the tariff as it is presented to them.

In the second place, the total number of undertakings gives a false impression of the real facts. What is of interest is the number of different tariffs which are offered to consumers, not the number of separate distribution channels through which the supply is brought. And in an inquiry of this nature it is necessary to bear in mind that a few large undertakings supply a very large proportion of the total consumers.

Thirdly, Britain is an industrial country with the majority of the population concentrated in large towns or in groups of large towns. Furthermore, it is the common practice for large towns to supply the nearby rural areas, so that when this is borne in mind electricity supply, as far as the number of consumers is concerned, is largely "urbanised."

### Results of an Inquiry

The scope of the inquiry was limited to towns of over 100,000 population. In the British Isles, excluding London, but including Wales and Scotland, there are 44 such undertakings. It will be realised that these with their surrounding rural districts constitute a very large proportion both of the total population and of the number of customers connected to the mains, so that any conclusions which may be drawn from a study of these undertakings will be covering the majority of the consumers.

London has been excluded. The 80 or so different undertakings in London present a problem in themselves, and the multiplicity of ownership is an effect of past legislation. Even in London the position is not so bad as is commonly believed. Many of the smaller companies are under the wing of a large company and pursue a common policy with regard to sales and tariffs, and of the others the recent grouping of the West End companies has resulted in a large measure of co-ordination of policy.

Of the 44 towns considered 38 offer two-part tariffs to domestic consumers. They are classified as follows:—

| | No. | Per cent. | Percentage of Total. |
|---|---|---|---|
| Rateable value ... ... ... ... | 29 | 76 | 66 |
| Size of house (floor area) ... ... | 6 | 16 | 14 |
| Number of rooms ... ... ... | 2 | 5 | 4 |
| Other ... ... ... ... ... | 1 | 3 | 2 |
| | 38 | 100 | 86 |

The last tariff is that of Birmingham Corporation. The Electric Supply Department does not give the basis of the charge, but states that, on application, a fixed charge will be quoted. It would appear to be some form of fixed m.d. charge. There is also one other addition to the above. Southampton has two alternative two-part tariffs, one based on rateable value and the other on the number of rooms. In the above table the tariff has been included under R.V. and excluded from the room rates.

There is no reason for any confusion to arise owing to the different bases of the tariffs except for people who move from one district to another. Bearing in mind the population served, the odds are considerably in favour of a consumer moving from one R.V. area to another R.V. area. Even when all undertakings are taken into consideration it is more than an even chance that a consumer will move into a district where he is, or should be, familiar with the tariff.

Of the six undertakings which are not included one only does not offer a two-part rate of any description, but it does offer a special cooking rate. The other five all employ Wright rates, *i.e.*, two-part tariffs in form without the compulsory fixed charge. Three of these base their charges on the number of rooms, one on rateable value and one on m.d. of lighting.

There would probably be some confusion in the minds of consumers in the case where they move from one district where there is a conventional two-part tariff to one where there is a Wright form of two-part tariff of whatever kind (and *vice versa*); but this difficulty is soon got over by the "receiving" undertaking pointing out the peculiar and invincible advantages of its own form of tariff, so that the consumer will believe that he is progressing.

These tariffs are certainly different in form from the majority which we have found to be in force, but it cannot be said that for that reason they are tariffs which should be eliminated. They have certain advantages not possessed by the orthodox two-part tariffs.

### Variation of Assessments

It will be noted that in the above figures all rateable value tariffs have been included under the one heading. Now, these tariffs in themselves show considerable variation. Some are fixed percentages of the rateable value, while others are "blocked" fixed charges, such as 20 per cent. on the first £30 of R.V., 10 per cent. on the R.V. between £30 and £50 and 5 per cent. on all excess. On the face of it these different forms of rateable value will give some cause for confusion. But not very much.

All that the majority of consumers know is that the supply authority bases its charge on the rateable value and quotes a charge accordingly. The consumer generally comes into the offices to have the sum worked out for him. All that he does with reference to his fixed charge, no matter on what it is based, is to complain that it is too high.

Confusion between different undertakings is bound to arise under the rateable value system of charging. There is no settled method of valuation for rating. Methods are entirely different in England and Scotland. Even within the same towns in England the assessment of rateable value is an art and a mystery which cannot be understood by the uninitiated. A comparison of the percentage of R.V. charged for electricity in one town with that charged in another gives no criterion. Some are as low as 5 per cent., others are up to and over 20 per cent.

The tariff which appears to offer the greatest degree of uniformity between methods of charging is the one which of necessity must result in considerable differences on paper, although the amounts in money paid by the consumer may not be substantially different.

In spite of the fact that the Committee appointed by the Electricity Commissioners to study the question of tariffs was not in favour of the R.V. system, it is surprising to what extent the local taxation basis still operates. The well-known disadvantages of the system, which are detailed by the Committee, acquire additional force with the present tendencies in distribution. Rightly or wrongly, we are likely to see an extension of the large distribution undertaking and a reduction in the number of selling authorities.

### The Position Under Co-ordination

Districts which are brought within the sphere of a R.V. undertaking will have a tariff based on R.V. offered to them. The existing confusion due to distribution areas covering several local government areas will be increased. Two neighbouring undertakings with their charges not dissimilar may be brought into the area of a large distribution authority. It may be that because of large differences in the rating authorities' methods one group may be offered a reduction in their existing charges while a second group will find that co-ordination has increased their bills.

It is, of course, perfectly true that the controlling supply authority would be able to, and probably would, make allowances for the differences in rating policy between the constituent areas of its newly acquired property. But concessions or allowances in the interests of justice would destroy uniformity, which is one of the aims of co-ordination.

Rating authorities are in the position of having to raise a certain sum to cover the expenses of government. So long as this sum is obtained it matters little whether they have a high rateable value and a low rate in the pound or *vice versa*. Electricity undertakings are in a similar position. They have to raise certain sums from the consumers to cover the costs of supply. Within the limits of one town these two policies may coincide sufficiently to form a working hypothesis. Where the area of supply is constantly expanding this policy will break down somewhere.

The two main conclusions which have been drawn from this survey are that the charges of unnecessary and excessive multiplicity of tariffs which is imputed to the electricity industry is not proved and is definitely untrue when the population served is taken into account, and that, paradoxically, the tariff which gives the greatest amount of uniformity between different undertakings at present is the one which is likely to offer the greatest bar to co-ordination in the future.

# Patents, Designs and Trade Marks

THE 54th report of the Comptroller-General of Patents, Designs and Trade Marks is now available, and, as usual, it contains a very full account of the business of the Patent Office. The data which chiefly concern our readers are those relating to patents, although particulars with regard to registered designs and trade marks are by no means without interest. It is noticeable that the applications for patents have fallen from nearly 40,000 in 1930 to less than 36,000 in 1936.

While there is a certain body of opinion which regards patents on the file merely as a network of obstacles to freedom of design, and who would therefore be in favour of the repeal of the Patent Acts, we still consider that the protection of inventions and improvements is quite as important as copyright in literary works, and that our patent laws are urgently in need of reform.

If the business of the Patent Office continues to decline at the present rate something will no doubt be done about it, as the Treasury will notice a reduction in the surplus of receipts over expenditure, which last year amounted to nearly £246,000. This is not only the least justifiable of taxes, but one of the most devastating ever imposed on progressive industry. If instead of exacting these sums from the inventors of the country, who are probably the least able of any class to pay such sums, Parliament were to vote a subsidy to assist progress in invention, it would be a much more rational proceeding.

The effect of the renewal fees which have to be paid year by year is very clearly shown in Appendix F, from which it appears that as soon as the renewal fees begin, in the fifth year, 64 per cent. of patents are dropped, while only 4.6 per cent. of the total number of patents ever reach the full maturity of their sixteenth year. The total fees payable on a patent granted in the United Kingdom, provided all goes smoothly and no extra fees are required for amendments or extensions of time, amount to £130. If an Empire patent is required, the fees payable in the various Dominions and Colonies amount to an enormous additional sum—an expense which very few people ever think of incurring.

Contrast this state of things with the patent law in America, where there are no renewal fees to torment the inventor, but merely a first payment of £7, after which, if a patent is accepted, whereby his rights in his "intellectual property" are confirmed, his protection (covering every state in the Union) lasts without further payments for seventeen years. After this the invention becomes public property, as in this country. The results can clearly be seen in the immense progress made in the United States in inventions and improvements. To put it briefly, the policy of the United States Government appears to be to foster and develop invention as much as possible, while that of this country seems to be intended to starve out all but 4 per cent. of the inventions approved and accepted. At all events, that is the actual result of the proceedings.

The Comptroller-General's report shows that he revoked only three patents during the year. He conducted over 6,000 hearings with regard to disputed points, and in only a very few cases was there any appeal from his decisions. It is common knowledge that proceedings in the courts for infringement are getting less and less frequent, the reason, no doubt, being the enormous cost of such proceedings. It is a branch of sport in which only the very wealthy can indulge, and will continue to be so until a special Patent Court is set up, with reasonable fixed fees, to make decisions finally and without appeal.

This reform is perhaps almost as much required as the reduction of the renewal fees to a first fixed payment with an extension of the protected area to include the whole of the British Empire. If the Chancellor of the Exchequer could persuade the Government to put through these reforms we think he would be surprised at the reward he would receive in the shape of increased revenue from income-tax.

# New Books

**The Physics of Electron Tubes** (Second edition). By L. R. KOLLER. Pp. 234; figs. 84. London: McGraw-Hill Publishing Co. Price 18s.

This volume from the International Series in Physics is an expanded edition of the original work which appeared in 1933. In it are discussed the fundamental phenomena occurring in the operation of electron tubes, and several chapters deal with thermionic emission and cathode design. Later in the book some attention is given to discharges in gases and to grid-controlled arcs, while in the final three chapters the practical aspects of photo-sensitivity, as applied to electronic devices, are covered in some detail. The author's method of treatment of electron tube phenomena should render this book valuable particularly to the teacher and student requiring an up-to-date manual.

Most of the sub-divisions of the subject are adequately treated without excessive examples or cross references, but each chapter is furnished with a reasonable bibliography which will be valuable to those requiring more detailed information.

A feature which will be useful to the more serious student is a series of problems dealing with the subject matter of each chapter. We have seen many diagrams illustrating Paschen's Law, but were somewhat surprised to find that the one reproduced by Mr. Koller gives such extremely low values for the breakdown voltages in argon, neon and hydrogen. One is doubtful whether the values given in fig. 44 can be obtained in practical forms of discharge tube.

The illustrations in this book are clear-cut and well reproduced. The method of paragraphing and the use of an adequate number of sub-headings simplify the treatment of a difficult subject. The book can be recommended to both physics students and engineers.

**Synthetic Rubber.** By W. J. S. NAUNTON. Pp. 162; figs. 19. London: MacMillan & Co., Ltd. Price 7s. 6d.

This is, as far as we are aware, the first book to deal with the subject in both its technical and economic aspects. The author, as head of the rubber laboratories of Imperial Chemical Industries, Ltd., while covering all types of synthetic rubber, naturally gives more space to the polymerised chloropene now known as Neoprene, which he states is the only artificial rubber generally available in Great Britain. Three chapters summarise the history, economics and future outlook of synthetic rubber generally. The background to the research is indicated in a chapter on "The Borderland between Rubber and Resins," where the chemical structure of rubber is correlated with its useful properties, followed by others on chemistry and physics. The technology of Neoprene is explained and details are given of its handling and milling characteristics, compounding, vulcanisation, processing, curing and moulding. Comparison is made between Neoprene and its differently composed equivalents now being produced abroad, and the book concludes with a section on synthetic rubber latex. Dr. Naunton's main conclusions are that there is a great field for a product that gives better service than natural rubber, even though more expensive, and that further research will enable synthetic rubber to be produced for particular purposes.

**Coronation floodlighting in two historic cities: Left: Buildings by the River Dee at Chester. Right: The West Door of Norwich Cathedral**

**The Modern Diesel.** Pp. 224; illus. London: Iliffe & Sons, Ltd. Price 3s. 6d.

That a fourth edition of this work should be called for within five years is a tribute to its usefulness as well as an indication of the rapid progress of the high-speed compression-ignition engine. The new edition has been thoroughly revised and has also been enlarged to cover recent developments in design for road, marine and air transport.

The earlier chapters (95 pages) discuss the principles underlying the design and operation of this class of engine, giving particulars of various constructional items in use. The characteristics of typical makes of engines are reviewed, and leading dimensions are given. A new chapter is devoted to rail-cars and locomotives both in this country and broad. The numerous illustrations include several instructive sectional and internal views.

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**Applications of the Method of Symmetrical Components.** By W. V. LYON. Pp. 579; figs. 255. London: McGraw Hill Publishing Co. Price 36s.

The theory of symmetrical components having been developed in America occupies there a more important position in the study of electrical technology than it does in this country. Professor Lyon's book contains the subject matter of the work done in this field by graduate students of the Massachusetts Institute of Technology, and it is a very complete treatise on the applications of symmetrical component theory to practical electrical engineering problems.

The opening chapter contains an interesting historical review of the subject, in which is traced its evolution, from the early conception of a rotating field set up by polyphase currents, to its perfection by the late Dr. Fortescue as a powerful calculus for the solution of a.c. problems. The basic theory of symmetrical components of the generalised polyphase circuit is treated analytically, and the applications of this theory to three- and four-phase circuits is worked out in detail, the various methods of measurement being very clearly explained.

In the main body of the work the use of the symmetrical component method in dealing with the performance of machines of various types in unsymmetrical polyphase circuits is fully developed, and the advanced student will find the three chapters on the induction machine of particular interest. The book, being intended for graduate students, requires a corresponding knowledge of mathematics for intelligent reading, and the bias of the method of treatment is perhaps on the academic side. It also suffers from the lack of an alphabetical index. Professor Lyon's work is a meritorious contribution to electrical literature, and those who desire to be acquainted with modern ramifications of the symmetrical component theory in its practical applications will find in it all that they require.

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**Examples in Thermodynamic Problems.** By W. R. CRAWFORD. Pp. 165; figs. 65. London: Sir Isaac Pitman & Sons, Ltd. Price 5s.

This book is made up of a series of questions and answers, and is intended for the use of students (especially those studying privately) who are preparing for examinations necessary to secure Higher National Certificates, engineering degrees, or entry to the Institutions of Civil or Mechanical Engineers. The range covers the heating and expansion of gases, entropy, cycle efficiencies, compression and refrigeration, variable specific heats, steam turbines and reciprocating engines, internal-combustion engines, and combustion. Many of the problems have been taken from past examination papers of appropriate bodies and appear to be well-chosen for their purpose, while the detailed working out of the solutions made in a large proportion of cases should be helpful in ensuring a rational appreciation of the principles involved.

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**The Decibel Notation and its Application to the Technique of Power Transmission.** By A. MORRIS. Pp. 57. Epsom: Dorling & Co., Ltd.

This notation is a mathematical artifice and so explainable only by symbols. That aspect is ultimately inescapable, but the author, who is a P.O. superintending engineer, has, nevertheless, attempted definition (with numerous numerical examples which he regards as essential supplements to the text) in words only, short and precise, with the object of crystallising ideas in order to form a basis upon which a mental picture may be built up.

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**Definitions and Formulæ for Students (Telegraphy and Telephony).** By E. MALLETT. Pp. 37. London: Sir Isaac Pitman & Sons, Ltd. Price 6s.

The author is the principal of the Woolwich Polytechnic and he has very decided views on how communication engineers should be trained. He has usefully brought together in this tiny booklet a large number of definitions and many formulæ that students will have to learn. There is no intention that it should replace any systematic textbook, since the uninstructed employment of formulæ is to be deprecated.

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## Shorter Notices

"Electric Power Development in the U.S.S.R." (Translated by L. E. Mins.) Pp. 496; figs. 105. London: Lawrence & Wishart, Ltd. Price 21s.

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# Presentation to L.S.E. Chairman

FOUR hundred people who gathered at dinner last week at Norwich to honour Mr. W. H. Scott, O.B.E., M.I.E.E., chairman and founder of Laurence, Scott & Electromotors, Ltd., on the occasion of his seventy-fifth birthday, heard much of interest relating to the work carried out by Mr. Scott and his company during the last fifty years.

Many of the members of the staff were there, and a walking stick and an illuminated address were presented to the principal guest and a silver tea service to Mrs. Scott, but the speeches and the way they were received showed to a greater extent the respect and affection which Mr. Scott enjoys among his many business associates and employés.

Major P. E. Glendenning, D.S.O., M.I.E.E., enumerated developments of the early pioneer period which Mr. Scott either originated or improved, including the multipolar motor, the use of mica insulation and ships' electrical equipment; Mr. William Reavell referred to the guest of honour's interest at one time in the thermal efficiency of the steam engine.

In saying that in "those days we did not always know just what we were trying to make," we think Mr. Scott must have had in mind his first dynamo, which would not excite because the field poles had no residual magnetism. But the "evolutionary" progress of his work suggests that his ideas have been based on fundamental principles.

**Mr. W. H. Scott, O.B.E., M.I.E.E., chairman of Laurence, Scott & Electromotors, Ltd.**

A more modern note was struck by Capt. G. J. Scott, managing director, who said that orders received by the company had increased from a value of £200,000 for the year 1932 to about £1,000,000 for 1936. Since the beginning of the slump they had made an enormous effort to develop the industrial market and for the first four months of 1937 the orders received for this class of electrical equipment totalled £120,000. The foundation stone on which the firm had been built was his father's inventive genius, and the progress that they were enjoying was due also to the spirit of duty, friendship, co-operation and harmony among the whole staff.

We took the opportunity of the visit to Norwich to see the company's two factories there—the Gothic Works in which most of the products other than standard motors and switchgear are manufactured, and the nearby switchgear factory. Standard industrial motors are produced at the company's Manchester factory. On the marine side we saw under construction a large batch of motors for the White Star Line, submarine electrical equipments for the Navy, generators and motors for the Holt Line, and auxiliary motors for the sister ship of the *Queen Mary* and for the Cunard "intermediate" ship.

On the industrial side we saw many examples of the "steel-frame" motor construction developed in recent years. This is used whenever possible for both d.c. and a.c. machines on account of its great strength and rigidity. The barrel is of rolled steel and the steel feet are welded to the barrel. The stator stampings are assembled under pressure and welded within a steel frame which, in turn, is welded within the barrel.

Many examples of the "Emcol" motor were also seen. Its pressed-steel radiating tubes between the motor shell and the outer casing are connected at each end to the inner shell. An internal fan circulates the clean air sealed within the shell through the motor and the tubes, while an external fan forces cool air over the exterior surface of the tubes and the outer face of the stator laminæ. Among orders in hand are 1,600-h.p. vertical "hyposynchronous" equipments for the Rand Water Board, a 560-h.p. power-station auxiliary drive and units for the Handley Page wind tunnel.

The Gothic Works is at present being extended by a five-bay structure which will be laid out mainly with two large welding sheds—for production welding and for routine testing.

# Business and Industrial Notes

**The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.**

## The E.C.A. Conference

Owing to force of circumstances it has been found necessary to change the venue of this year's conference of the Electrical Contractors' Association from Blackpool to Llandudno. The dates will remain unaltered, and provisional arrangements have already been completed. Proceedings will start on Wednesday evening, June 23rd, with a reception by the president of the Association, Mr. H. M. Drake, at the Grand Hotel, the headquarters. A civic reception at the Winter Garden Ballroom the next morning will be followed by the presidential address, and a paper (probably by the two sons and nephew of Mr. H. E. Walker, of Birmingham) with the title "This Business of Retailing and Contracting: Its Organisation and Service to the Country." A second paper on the labour aspects of the Association's work will be read in the afternoon, a smoking concert followed by dancing at the Winter Garden Ballroom occupying the evening. On the Friday the annual general meeting will be held in the morning and, if fine, a garden party has been arranged for the afternoon at the miniature golf course at Happy Valley. A *thé dansant* at the Winter Garden Ballroom is planned should the weather be unfavourable. A ball and cabaret at the Grand Hotel will conclude the conference. Mr. L. C. Penwill, director and secretary of the Association, tells us that there are indications of a record attendance this year, and recollections of the happy time spent at the 1930 Llandudno conference will no doubt influence many.

## The New Cleethorpes Showrooms

The new showrooms of Cleethorpes Corporation Electricity Department were formally inaugurated on May 10th by the Mayor, Ald. E. Houghton, who said that Cleethorpes in 1885 became a pioneer in the use of electricity for public purposes in the north-east of Lincolnshire, most of the district being lighted by arc lamps. In those days they had a population of 3,000, and now they had an estimated population of 32,000. The Cleethorpes electricity undertaking had progressed in keeping with the rest of the town's public life. Councillor J. Croft Baker (chairman of the Electricity Committee) paid a tribute to the work of Mr. B. S. Lord, the borough electrical engineer. The new showrooms are situated in the centre of the developed area of the borough. The ground floor contains the main showroom and has three display windows. On this floor there are also a demonstration kitchen, staff room, stores, mains and drawing office, and meter-testing room. An electric lift has been installed to convey visitors to the floor above. The main feature of this floor is a demonstration room, provided with a platform at one end, which will be used for demonstrations, lectures and social functions. There are also a kitchen for the preparation of meals required to be served in the demonstration room, and administrative offices. The coloured lighting for the showroom windows and demonstration room is controlled by an automatic dimmer, so arranged that varied colour effects can be obtained. The heating arrangements are by tubular heaters and convectors, each separately controlled by thermostats. The electrical fittings were supplied by the following companies:—General Electric Co., Ltd. (main showroom); Falk Stadelmann & Co., Ltd. (showroom windows, demonstration room, offices, &c.); Unity Heating, Ltd. (tubular heaters and convectors); Johnson & Phillips, Ltd. (wires and cables); C. H. Potts & Co., Ltd. (tower clock).

## The Irish Lamp Factory Closes

Solus, Teóranta, the only factory manufacturing electric lamps in the Free State, has closed down. Our Irish correspondent informs us that the present situation has been brought about by the hold which Japan has secured on the I.F.S. market, despite the quota restrictions and Customs duties on foreign electrical goods. When the factory opened in February, 1935, it was given the protection of a 75 per cent. tariff and a quota system was instituted. The cost price of Japanese lamps generally in Dublin is so low that even the raw material for the home factory is many times higher. The margin of difference is thus so wide that the home industry has been crippled. Mr. J. J. Walsh, chairman of Solus, Teóranta, stated in an interview that the factory at Bray, Co. Wicklow, was in a position to supply the country's requirements of every conceivable kind of lamps, but it was futile for them even to try to compete with the imports of cheap goods from abroad. The cost price of automobile lamps now being imported into the country was about one-third of the cost of production by them. The low prices had a special appeal to a wide range of people and their market was being reduced to about half its normal dimensions. The Free State has a sale of about one million electric lamps, apart from other lines, per annum, but the output of Solus, Teóranta, has been reduced to about half its capacity. Mr. Walsh stated that they had no intention of lowering their standard of production, and for the present they must close down. The decrease in the market for their lamps meant that they were now several months in advance of consumption. His company had approached the Ministry for Industry and Commerce on many occasions, but so far nothing had been done. Unless an embargo was placed on foreign imports they could not carry on. It all depended on what action the Government would take. The British combine did not affect his firm greatly as they both produced lamps of virtually the same quality and price. No Dublin street lamp was Irish-made.

Solus, Teóranta, which was registered as a company in February, 1935, has been in constant production since that time. It has a nominal capital of £100,000, of which £50,000 has been issued and paid up. The directors are Messrs. J. J. Walsh (chairman), D. Frame, M. J. McCabe, R. G. Duggan and W. O'Reilly, and the shareholders number about 380. The company is said to be strong financially and efficient in management and quite able to undertake all necessary expansion to supply home needs.

## Alleged Breach of Agreement

At Weston-super-Mare on May 5th, before His Honour Deputy Judge F. A. Wilshire, Mr. H. W. C. Hinchley, Cardiff, applied for sanction to an agreement between himself and Mr. A. Paxton and Paxton's (Cardiff), Ltd., now of North Street, Weston, for an injunction against respondents to restrain them from further breaches of an agreement dated April, 1936, and payment of £50 damages and £30 towards plaintiff's costs. Mr. Cary Evans, for plaintiff, explained that Mr. Paxton and Mr. Hinchley had been in business at Cardiff for sixteen years and worked in harmony as directors of Paxton's (Cardiff), Ltd. In April, 1936, there were disputes between the parties, and they considered it advisable to separate. The business was of such a character that it could be conveniently divided into two branches, one the manufacture of electrical contacts and the other the sale of electrical goods manufactured by

**The premises of Venner Time Switches, Ltd., New Malden, decorated and floodlighted for the Coronation celebrations**

others. It was decided that Mr. Hinchley should retain the Cardiff works and continue the manufacture and sale of electrical contacts, and Mr. Paxton the other part of the business, but an express term of the agreement was that neither party should compete against the other. Mr. Hinchley complained that this agreement had not been observed by the defendant, and that he had omitted to pass on to plaintiff, as agreed, orders for electrical contacts sent to Paxton's (Cardiff), Ltd., by a large number of the best-known firms in the country. Mr. Evans said that the defendant was apparently willing to sign the injunction restraining him from further breaches of this clause of the agreement, and also to pay £50 damages, and £30 costs. Mr. Hinchley was willing to accept these terms. Mr. A. H. G. Griggs, for respondent, stated that Mr. Paxton was also agreeable to the injunction. His Honour granted the application with damages and costs as stated.

## A Road Transport Guide

The second issue of "The Goods by Road Transport A.B.C.," compiled by Mr. G. H. Bettinson (Transport Publishing Co., 2s. 6d.), contains particulars of over 800 haulage contractors operating from 300 base towns. Its object is to provide traffic managers of manufacturing concerns using the services of outside haulage contractors with a concise list of regular services to and from various parts of the country. There are forty-seven maps, either copied from H.M. Ordnance Survey or specially drawn for the A.B.C. by the Royal Automobile Club. A trades directory is incorporated, and for the convenience of manufacturers sending goods abroad there is a list of leading shipping brokers operating from fifteen ports.

## Mining Equipment in South Africa

The annual "Stores Consumed" returns of the mining industry of South Africa, published in the *South African Mining and Engineering Journal*, show that during 1936 the value of electrical machinery purchased was £1,836,927, of which £1,774,809 was in respect of imported equipment. Spares and fittings for electrical machinery amounted to a further £159,458 (imported, £134,272) and electric detonators or fuses to £52,998 (imported, £2,557). In addition, £2,707,558 was spent on the purchase of electrical energy.

## The Paris Fair

In order that the inauguration of the Foire de Paris may coincide with the first week of the six months' exhibition (which is now being definitely opened on May 24th), the opening date has been deferred until May 22nd, and the Fair will close on June 7th, one week later than previously announced.

## Price Increase

Bertram Thomas have increased their prices still further with regard to steel storage equipment on account of the recent advance in the price of steel.

## Trade Announcements

Mr. D. R. S. Martin, of 38, Bedford Street, Belfast, has been appointed by Veritys, Ltd., to look after their interests in Northern Ireland.

Michael Black, Ltd., radio, electrical and cycle factors, of Glasgow, have removed their Aberdeen branch to larger premises at 96, Rosemount Viaduct, Aberdeen.

The Martindale Electric Co., Ltd., is moving at the end of this month to a new factory in Westmorland Road, adjoining Queensbury Station, The Hyde, N.W.9. The telephone number will be unchanged.

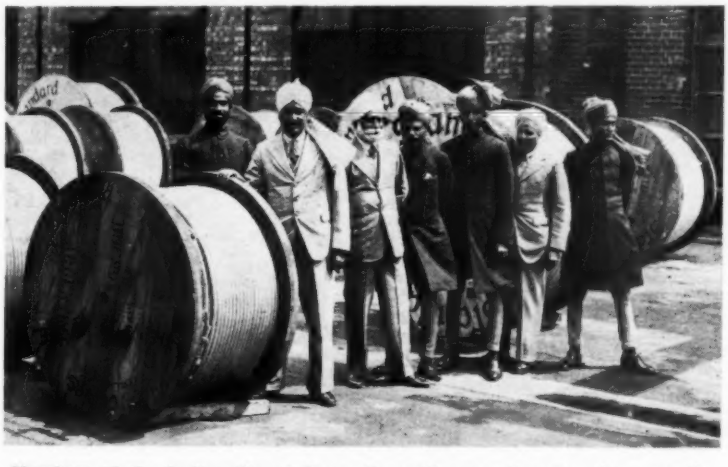
The telephone number of Elliott Bros. (London), Ltd., has been changed to Tideway 3232.

Maurice Bobin, table-lamp and lamp-shade manufacturer, has removed to 78, Milton Street, Moorgate, E.C.2 (telephone: Metropolitan 7653).

The telephone number of the Dublin branch of the General Electric Co., Ltd., has been changed to Dublin 71141/4.

## Social Events

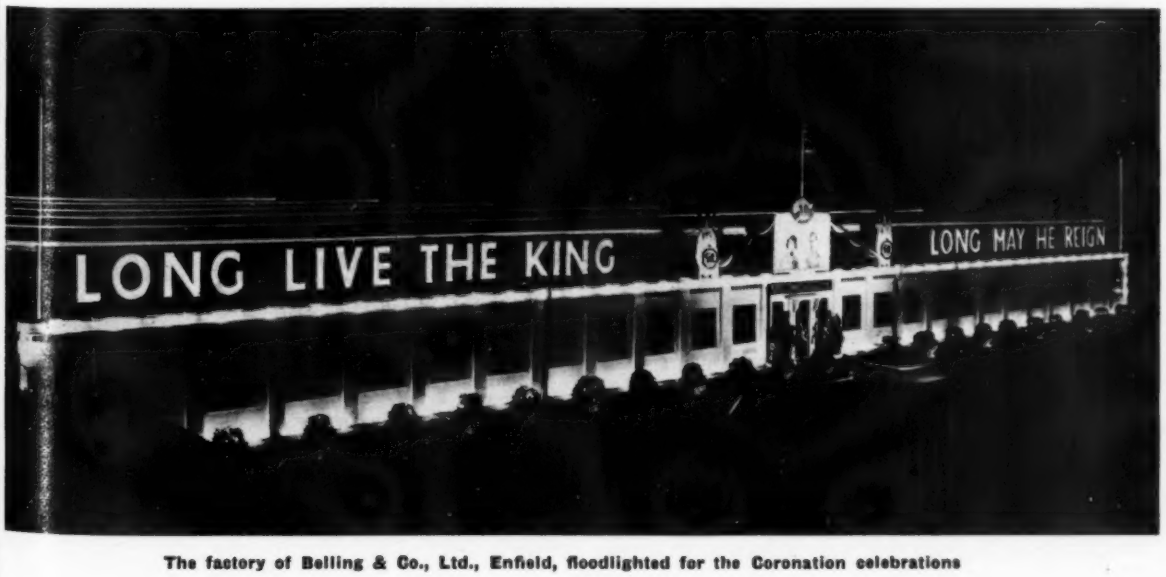
The Shropshire Distribution Section of the West Midlands J.E.A. Sports Club celebrated the Coronation by holding a ball at the Palais de Dance, Wellington, on May 12th. There was an attendance of over 400. A special attraction was the hall decorations, including flood and colour lighting schemes, while for the first time in this district cabarets were introduced. Another event was the final of a waltz competition which the club had organised in the Authority's distribution area. Col. J. Baldwin-Webb, M.P. for the Wrekin Division, was present, having travelled specially from London, and he presented the various prizes won during the evening. Before he left, Miss Pass, on behalf of the Wemjea Club, presented him with a cut-glass cigarette casket, also a cut-glass flower vase for his sister, Miss Webb, who was unable to be present.



**Members of the Indian Signal Corps Coronation contingent who recently visited the North Woolwich Works of Standard Telephones & Cables, Ltd.**

## British Overseas Electrical Trade

The Board of Trade returns for April give the value of British electrical exports as £1,594,561, which compares with £1,674,234 in the corresponding month of 1929, the year when trade reached its maximum prior to the depression. Last month's total is higher than for any month since then, and compared with April, 1936, there is an increase of £381,499, or 31 per cent. It is necessary to take into account, however, the fact that last month contained twenty-six working days against twenty-four in April, 1936, owing to the earlier incidence of Easter this year, while the rise in commodity prices must also be borne in mind. Electrical imports last month were of the value of £433,587, as compared with £342,984 in the corresponding month of last year, an increase of £90,603 (26 per cent.).




**The factory of Belling & Co., Ltd., Enfield, floodlighted for the Coronation celebrations**

### Floodlighting the National Maritime Museum

Referring to our notes on the floodlighting of the National Maritime Museum, Greenwich (see last week's issue, page 720), Graham Farish, Ltd., inform us that they supplied a battery of thirty-six 150-W floodlights for illuminating the columns of the building.

### Large Railway Contract

Cowans, Sheldon & Co., Ltd., Carlisle, have been awarded the contract by the L.N.E.R. for three 70-ft. diameter locomotive turntables for the new electric locomotive shed at Darnall. The scheme is part of a £2,500,000 project for the electrification of the lines between Manchester and Sheffield and Wath.

### Local Exhibition

At a trades exhibition held in the Winter Gardens, Deal, and opened on May 12th, Mr. B. Bright, electrical contractor, had a display of Vactric cleaners. In the annexe the South-East Kent Electric Power Co. had a comprehensive display of cookers, refrigerators, and washing machines, and one side of the hall was occupied by Messrs. Smiths, who showed a variety of electrical apparatus.

### For Sale

Kingston-on-Thames Electricity Department has for sale miscellaneous apparatus.

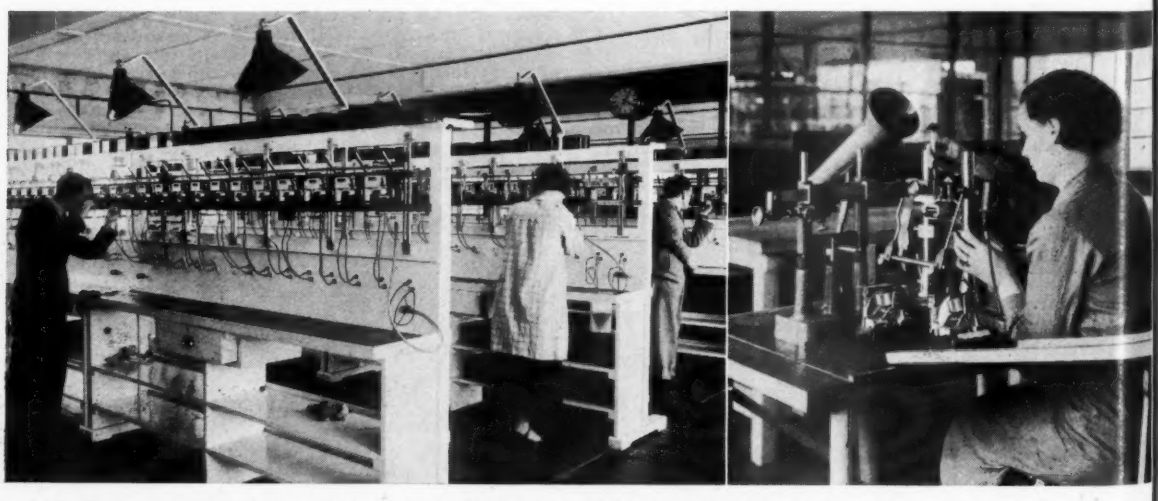
(See our classified advertisements.)

### An Electrical Accessories Factory in Manchester

The Manchester City Council has received a report from the Wythenshawe Estate (Special) Committee dealing with the proposal to lease a plot of land to a firm of electrical engineers for the manufacture of electrical accessories. The firm has made application for a loan towards the cost of erecting its factory, estimated at £7,000. The report states the factory would probably employ fifty people at the start. Satisfactory references have been obtained, and the Corporation proposes to advance £4,666. The loan will be repaid with interest at 4 per cent. per annum over a period not exceeding fifteen years.

### A New Meter Factory

With the opening of its new factory in Kingsbury Road, London, N.W.9, Rex Meters, Ltd., is now in a position to produce an entirely British electricity meter. All the metal pressings required are produced in a well-planned machine shop on the ground floor of the new building, the machinery, of the latest type, including presses, lathes, a furnace for hardening small tools, coil winders, and grinding, milling, tapping and drilling machines. Adjoining this shop is a paint-spraying room and the remainder of the ground floor is employed as a store room for components, sheet metal, tools, &c. Most of the first floor is occupied by the assembly department, which, too, is surprisingly well-equipped for a factory of its size. Probably the most interesting part of the works, however, is a test room. A feature of the main testing benches, which are arranged in rows taking twenty-five instruments each, is an ingenious device for starting and stopping all the meter discs at the same time. Special dial tests are carried out on a separate board. The test boards were supplied by the Power Equipment Co., Ltd., and are illuminated by Benjamin "Crysteel" lamps. Such components as the meter cases, gears, &c., which are not produced in the factory are all now made in this country. At present production is practically confined to ordinary single-phase meters, either in metal or bakelite cases, the imitation walnut finish of the latter being very pleasing. Mr. F. Thompson, the company's sales director, tells us, however, that its prepayment model is being redesigned and, it is hoped, will be on the market towards the end of the year.



**Left: The test room at the new factory of Rex Meters, Ltd. Right: In this dial-meshing machine the operator can see the gear wheels magnified about thirty times**

### Irish Free State Electrical Imports

So far this year there has been a very active tone as regards the imports of electrical machinery and allied material into the Irish Free State. The imports during March last attained a value of £75,375 as compared with £70,746 in the corresponding month of 1936. The details of the imports during the first quarter of the current and past years are shown in the appended table :—

| | January to March. 1936. | 1937. |
|---|---|---|
| | £ | £ |
| Electric motors | 14,371 | 11,221 |
| Other electrical machinery | 34,876 | 48,329 |
| Dry batteries and parts | 3,605 | 3,732 |
| Electric lamp bulbs | 15,321 | 6,219 |
| Elec. lighting accessories, fittings and parts | 24,761 | 19,823 |
| Electric wires and cables, insulated | 21,781 | 19,892 |
| Telegraphic and telephonic apparatus | 2,628 | 24,947 |
| Radio receivers, complete | 12,632 | 21,581 |
| Radio-gramophones, complete | 334 | 494 |
| Other radio apparatus, fully or partly assembled | 1,405 | 3,025 |
| Radio parts and accessories | 15,807 | 21,992 |
| Other electrical goods | 72,458 | 74,300 |
| Totals | £219,959 | £255,562 |

As will be seen, there has been an increase in imports of £35,893. Four of the scheduled items show a decrease and eight an advance, the most notable being telegraph and telephone material and radio receiving sets and allied goods.

### Kelly's Directory

The 1937 edition of "Kelly's Directory of the Merchants, Manufacturers, and Shippers of the World," which has just been published (Kelly's Directories, Ltd., 64s.), consists of two volumes. The first contains information relating to export and import, shipping and manufacturing industries in all the countries of the world (except the British Empire) and is divided by continents as follows; Europe; Asia; Africa; America (Central, North and South), and the West Indies. The division for each continent contains in alphabetical order sections for the countries which form part of the continent. The section for each country contains in alphabetical order sub-sections for the towns in that country. The sub-section for each town is divided in its turn into trade headings arranged in alphabetical order, and under the trade headings are given the names and addresses. For the United States there is a general trades classification, where the names of those engaged in any trade throughout the country appear in one alphabetical list under the heading referring to that trade. The second volume deals with the British Empire, and is divided as follows: Great Britain and Ireland; the British Dominions, Colonies, Possessions, Protectorates, and Territories under British Mandate in Europe; in Asia; in Africa; in America; in Australia, and in New Zealand. The section for Great Britain and Ireland is divided into three parts: England, Scotland and Wales (except London); London; and Ireland. Each part contains an alphabetical list of firms, a classification of the firms under trade headings, a list of telegraphic addresses, and separate lists of the exporters and importers arranged alphabetically under the headings of the goods which they either export or import. A great deal of other information is included, and there is a complete index in four languages.

### Calendar

The 1937-38 calendar which we have received from Bruce Peebles & Co., Ltd., in commemoration of Coronation year bears a picture of Balmoral Castle, and the colour scheme adapts the Coronation colours. It has monthly tear-off sheets and at the top of each are pictures of the company's products

## Australian Electrical Notes

An Australian correspondent reports that quota restrictions on the importation of radio receiving valves into Australia have been eased recently, a quota of 25 per cent. having been granted for American valves for the six months' period from July 1st to December 31st, 1937. Owing to the large number of types used for commercial communication, broadcast transmission, and experimental transmission, permits will be issued freely for the importation of transmitter valves and transmitter rectifying valves.

The extensions to the East Perth power station are now well advanced. The steel framework of the building is practically completed and concrete walls are being built. The boilers are installed, together with the coal-pulverising plant, the superheater, economisers, air heaters, dust precipitator and other equipment. A 25,000-kW turbine is an object of interest to visiting engineers, particularly as the plant will operate, from centralised control, at a steam pressure of 600 lb. and at a temperature of 800 deg. F.

## New Catalogues and Lists

**Siemens Electric Lamps & Supplies, Ltd.,** 38-39, Upper Thames Street, London, E.C.4.—Details of a new "Lumenic" lighting unit are given in a new leaflet, while list 491 deals with fans.

**Marelli & Co., Ltd.,** Artillery House, Artillery Row, Victoria Street, London, S.W.1.—A new fan list (F.1937) together with leaflets F/380 and F/421 giving prices and details of all standard types of electric fans.

**Switchgear & Cowans, Ltd.,** Elsinore Road, Old Trafford, Manchester, 16.—A new publication dealing with duplicate bus-bar "change-over-on-load" internal isolation switchgear.

**F. W. Read & Sons, Ltd.,** 175-179, Gray's Inn Road, London, W.C.1.—A catalogue of "Readson Duo-Ray" infra-red apparatus.

**Cambridge Instrument Co., Ltd.,** 45, Grosvenor Place, London, S.W.1.—Dynamometers and a.c. test sets are dealt with in folder No. 57.

**Elliott Brothers (London), Ltd.,** Century Works, Lewisham, S.E.13.—Details of the "G.L.C." automatic flue damper and "Siemens" flowmeters.

**James Keith & Blackman Co., Ltd.,** 27, Farringdon Avenue, E.C.—"K.B." air-heater units are the subject of a new leaflet.

## Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

| CHEMICALS, ETC. | Price. May 19th. | Fortnight's Inc. or Dec. |
|---|---|---|
| [a] Acid Oxalic ... ... ... ... per cwt. | 50s. | — |
| [a] Ammoniac, Sal ... ... ... per ton | £36 | — |
| [a] Ammonia, Muriate (large crystal) ... „ | £18 10s. | — |
| [a] Borax ... ... ... ... „ | £17 | — |
| [a] Copper, Sulphate ... ... ... „ | £15 10s. | — |
| [a] Potash, Chlorate ... ... ... per lb. | 3½d. to 4½d. | — |
| [a] „ Perchlorate ... ... ... „ | 6d. | — |
| [a] Shellac... ... ... ... per cwt. | £4 18s. | — |
| [a] Sulphur, Commercial ... ... per ton | £11 | — |
| [a] „ Roll... ... ... ... „ | £11 | — |
| [a] Soda Chlorate ... ... ... per lb. | 3½d. to 3¾d. | — |
| [a] „ Crystals... ... ... ... per ton | £5 to £5 5s. | — |
| [a] Sodium Bichromate, casks ... ... per lb. | 4d. nett. | — |
| METALS, ETC. | | |
| [b] Aluminium, Ingots ... ... ... per ton | £100 to £105 | — |
| [b] „ Wire ... ... ... per lb. | 1/1 to 1/9 | — |
| [b] „ Sheet and Foil... ... „ | 1/3 to 2/9 | — |
| [p] Babbitts Metal and Anti-friction Metals— | | |
| Grade I ... ... ... ... per ton net | £232 | £2 inc. |
| Grade II... ... ... ... „ | £162 | £2 inc. |
| Grade III ... ... ... ... „ | £88 | £1 inc. |
| [c] Brass (rolled metal 2" to 12" basis) ... per lb. | 9½d. | — |
| [c] „ Tubes (solid drawn) ... ... „ | 1/0½ to 1/1 | — |
| [c] „ Wire, basis ... ... ... „ | 10½d. | — |
| [c] Copper Tubes (solid drawn) ... ... „ | 1/2¼ | — |
| [c] „ Bars (best selected) ... ... per ton | £95 | £2 inc. |
| [c] „ Sheet ... ... ... ... „ | | |
| [c] „ Rod ... ... ... ... „ | £66 | 10s. inc. |
| [c] „ (Electrolytic) Bars ... ... „ | £71 | 10s. inc. |
| [d] „ „ Wire Rods ... ... „ | 10½d. | ¼d. inc. |
| [d] „ „ H.C. Wire ... per lb. | 1/10 to 2/9 | — |
| [f] Ebonite Rod ¼" dia. & up ... ... „ | 1/7 to 1/10 | — |
| [f] „ Sheet ¼" thick & up ... ... „ | 2/5 | 1d. dec. |
| [n] German Silver Wire, Nos. 1 to 12 ... „ | nom. | — |
| [h] Gutta-percha, fine ... ... ... „ | 11d. | ½d. dec. |
| [h] India-rubber, Para-fine ... ... „ | £4 5s. 0d. | — |
| [i] Iron, Pig (Cleveland, No. 3) ... per ton | £20 | — |
| [i] „ Wire galv. No. 1, P.O. Qual.... „ | £25 | £1 10s. dec. |
| [g] Lead, English Pig ... ... ... „ | £15 12s. | £1 15s. inc. |
| [g] Mercury ... ... ... ... per bot. | 10d. to 2/– | — |
| [e] Mica (in original cases) small ... per lb. | 6/– to 12/6 | — |
| [e] „ „ „ medium ... „ | 13/– to 17/6 up | — |
| [e] „ „ „ large ... „ | 1/3¼ | — |
| [p] Phosphor Bronze, plain castings ... „ | 1/3½ | — |
| [p] „ „ drawn bars & rods „ | 1/1½ | ½d. inc. |
| [p] „ „ rolled strip & sheet „ | 1/3½ | ½d. inc. |
| [p] „ „ wire ... ... „ | £11 5s. | — |
| [o] Platinum ... ... ... ... per oz. | 10 7/8d. | ½d. dec. |
| [d] Silicium Bronze Wire ... ... per lb. | £21 17s. 6d. | £2 dec. |
| [g] Spelter ... ... ... ... per ton | 7½d. | — |
| [r] Steel, Magnet, in bars ... ... per lb. | £249 5s. | £3 5s. dec. |
| [g] Tin, Block (English) ... ... per ton | 4/6 | — |
| [n] „ Wire, Nos. 1 to 16 ... ... per lb. | | |

Quotations supplied by :—

[a] G. Boor & Co.
[b] The British Aluminium Co., Ltd.
[c] Thos. Bolton & Sons, Ltd.
[d] Frederick Smith & Co.
[e] F. Wiggins & Sons.
[f] India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
[g] Henry Gardner & Co., Ltd.
[h] Edward Till & Co.
[i] Bolling & Lowe.
[n] P. Ormiston & Sons.
[o] Johnson Matthey & Co.
[p] C. Clifford & Sons, Ltd.
[r] W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes."

## Bankruptcy Proceedings

**J. English,** 237, Alcester Road South, Kings Heath, Birmingham, radio and electrical engineer and contractor, &c.—At the first meeting of creditors herein it was reported that the gross liabilities totalled £527, of which £478 was expected to rank for dividend, with a deficiency of £453. The debtor attributed his failure to lack of capital, drawing in excess of profits and depreciation in the value of fixtures and fittings. The case was left in the hands of the Official Receiver as trustee.

**G. W. Linsell,** Tippendale Lane, Park Street, near St. Albans, lately 26, London Road, St. Albans, radio and electrical dealer.—This receiving order was made on a creditor's petition, and according to the statement of affairs the debtor has lodged there are gross liabilities of £2,212, of which £1,444 is expected to rank for dividend, against net assets of £623, with a deficiency of £821. The debtor attributes his failure to keen trade competition, profits insufficient to cover overhead expenses and personal drawings and depreciation in value of goods recovered from defaulting hire purchasers.

**M. G. Carpenter,** 38, Blackboy Road, Exeter, electric lamp dealer.—The receiving order herein was made on a creditor's petition. According to the statement of affairs lodged by the debtor the gross liabilities amount to £1,554, of which £1,553 is expected to rank for dividend, with assets of £11, leaving a deficiency of £1,542. The debtor ascribes his failure to insufficient takings in relation to expenses, want of free capital, car accident in November, 1935, which dislocated his business for six months, ill-health of daughter and loss occasioned by defective stock.

**W. F. Welford,** Roseberry, Alexandra Road, Shanklin, Isle of Wight, electrical engineer, lately trading with another in partnership as Welford Milne & Co., 55, Regent Street, Shanklin.—The application for discharge herein was heard at the Town Hall, Ryde, Isle of Wight, recently. The receiving order had been made last year. The discharge was granted subject to three months' suspension.

**A. B. Bowe,** 10, Scotland Road, Penrith, lately carrying on business at Corne Square, Penrith, Cumberland, radio, cycle and electrical dealer.—The public examination herein took place recently at the Court House, Carlisle. It was stated that the unsecured creditors' claims amounted to £700, whilst there were assets estimated to realise £196, and the deficiency totalled £504. Debtor attributed his failure to giving too much credit, family illness and hire-purchase losses. The examination was closed subject to the signing of the notes.

**L. W. Meredith,** electrical engineer, 2, Vine Road, Skegness, lately carrying on business at Prince George Street and High Street, Skegness.—Receiving order made May 6th on a creditor's petition. First meeting May 25th at 4 and 6, West Street, Boston. Public examination June 17th at the Municipal Buildings, Boston.

**R. A. Robinson** (Highbury Engineering Works), radio and electrical engineer, 287, Upper Street, Islington, N.1.—First and final dividend of 4s. 6d. in the £, payable any day (except Saturday), at Carey Street, W.C.2.

**T. Mehew,** electrical engineer, Victoria Road, Netherfield, Notts.—Last day for receiving proofs for dividend May 26th. Trustee, Mr. A. J. Rogers, 22, Regent Street, Park Row, Nottingham, Official Receiver.

**A. H. Lipman** (H. Lipman & Co.), electrical and general factor, 49, Jubilee Street, E.1.—Discharge suspended for two years and six months until October 16th, 1939.

**A. P. Steer,** wireless dealer, 73A, Fore Street, Bovey Tracey.—Trustee, Mr. W. R. Cocks, Exeter Bank Chambers, Broadgate, Exeter, Official Receiver, released April 30th.

**J. H. Pasco** (J. Danning), wireless engineer, 10, New Bridge Street, Truro.—Trustee, Mr. G. C. Hancock, 12, Princes Street, Truro, Official Receiver, released April 30th.

## Company Liquidations

**E. T. Turner, Ltd.,** Epsom and Esher.—The statutory first meeting of creditors and shareholders under the compulsory liquidation of this company, which carried on business as electricians and dealers in radio supplies at 24, Waterloo Road, and 77a, High Street, Epsom, also at 37, High Street, Esher, were held on May 10th at Carey Street, W.C. The failure of the company was attributed to lack of capital during recent years, to the percentage of profits being insufficient to cover overhead expenses, and to bad debts. The liquidation was left in the hands of the Official Receiver.

**Kingsway Electricals, Ltd.**—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. C. Russell, 6, Stone Buildings, Lincoln's Inn, W.C.2. The liquidator is authorised to consent to the registration of a new company with the same title.

**Hamilton Radio Co., Ltd.**—Winding up voluntarily. Liquidator, Mr. S. Thornton, Ellesmere Chambers, 13, Church Street, Preston.

**Temple Products, Ltd.**—Winding up voluntarily. Liquidator, Mr. F. E. Bendall, Midland Chambers, Warwick Passage, Corporation Street, Birmingham.

## Private Arrangements

**E. S. White,** trading as E. S. White & Co., Friars Gate, Warrington, and at Lymm, electrical contractor.—The creditors herein met recently, when the statement of affairs disclosed ranking liabilities of £1,425. The net assets were £140, leaving a deficiency of £1,285. It was reported that an offer was made to purchase the business assets for £300, and in the event of that offer being accepted cash claims totalling £625 would be withdrawn, which would reduce the liabilities to about £800. It was decided that the offer should be accepted, subject to the purchaser's assuming responsibility for the preferential claims, and it was also resolved that a deed of assignment should be executed in favour of Mr. A. T. Eaves, C.A., of Messrs. Harry L. Price & Co., 47, Mosley Street, Manchester, with a committee.

## Dissolution of Partnership

**R.M. Electrical Appliances,** retailers of vacuum cleaners and electrical appliances, 186, High Street, Penge.—Messrs. S. G. Gilles and V. Rigden have dissolved partnership.

# Electricity Supply

## Lighting, Domestic, Power

**Aberystwyth.**—PROMENADE LIGHTING.—Holiday visitors to Aberystwyth this year will find that they are able to enjoy their evening walks along a brilliantly illuminated promenade. The lighting is by means of thirty-six Revo C.6027 units, fitted with 160-deg. upper refractors and lenticular glass under refractors and equipped with 300-W gas-filled lamps. The units are mounted about 22 ft. high on Revo B.5972 double-arm brackets, with 6 ft. spread, erected on the existing standards, spaced approximately 150 ft. apart. An even and glareless light is provided.

**Barrow-in-Furness.**—NEW EQUIPMENT.—Sanction has been obtained by the Electricity Committee to borrow £2,135 for plant at Melampus Street sub-station, £3,558 for the erection of overhead lines and £24,234 for mains and sub-stations.

**Belgium.**—NEW POWER STATION.—In order to meet the increasing demand for supplies the Société Union Intercommunale des Centrales Electriques du Brabant has decided to establish a new power station at Droogenbosch, adjoining the existing station. The initial plant will comprise a 30,000-kW high-pressure turbo-generator set. The orders for 90 per cent. of the necessary equipment have been placed in Belgium and it is expected that the new station will be completed during the winter of 1938-39.

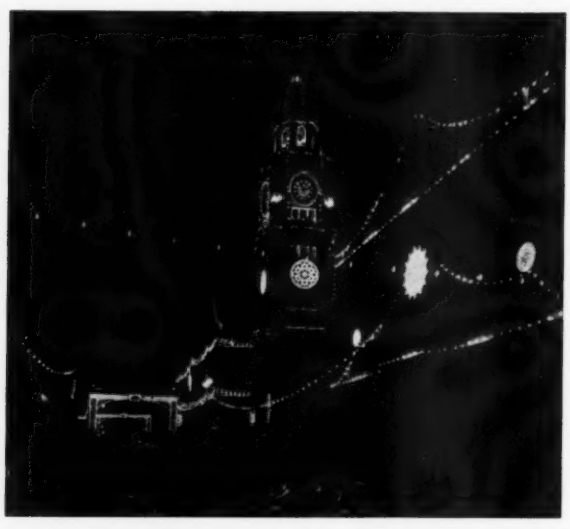
**Blackpool.**—ELECTRICITY REFERENDUM.—Tenants of houses on the South Shore estate are to be asked whether they desire electrical installations in their houses and whether they are willing to pay increased rents to cover the cost.

**Bristol.**—SUPPLY TO HOSPITAL.—Cables are to be laid by the Electricity Committee to the Ham Green Hospital. The scheme embraces the improvement of the electricity services at the hospital.

**Bridgend.**—RESULT OF INQUIRY.—Following the acquittal at Glamorgan Assizes of Mr. Trevor David, a former member of the Glamorgan County Council and Bridgend Council, on charges of publishing defamatory libels against Mr. William Welbury, electrical engineer to the Bridgend Council, and Mr. H. P. Williams, a member and former chairman of the Council, a Ministry of Health inquiry was held last December into the affairs of the undertaking. Mr. H. L. Murphy, K.C., who sat with Mr. A. N. East, an inspector of the Electricity Commission, has now issued his report, in which substantially the whole of the allegations made by Mr. David are found to be disproved.

**Carlisle.**—MAINS.—Extensions of mains are to be carried out by the Electricity Committee at a cost of £1,188.

**Croydon.**—DECORATIVE LIGHTING.—Owing to the large crowds of spectators the Corporation has extended the period of the Coronation illuminations in the Town Hall and public parks



**Coronation illuminations at Croydon**

until May 23rd. As many as 100,000 people have visited Grange Wood Park in one day. The Town Hall is outlined in coloured lights, and two ornamental pieces, each of some 1,000 lamps, have been erected on the main tower, while the front is festooned with large coloured lamps. Specially illuminated arches have been erected. The Town Hall Gardens have been a great attraction. They contain many illuminated features, including a specially designed rose bowl which acts as a very efficient and artistic floodlight over the flower beds; a similar device has been arranged in the other public parks. Grange Wood Park has been specially treated for the benefit of children and contains illuminated sets, including a pigmy fair and village of over 100 houses, together with figures, roundabouts and a Punch and Judy show. Other illuminated sets include Red Riding Hood, St. George and the Dragon, &c., and there are giant flowers and specially illuminated flower beds. Wandle Park also contains examples of floodlighting and various illuminated sets, together with an illuminated gondola on the lake. The library in Ashburton Park is floodlighted and there is an illuminated fountain with colour effects. The fountain at Thornton Heath Pond has been treated in the same manner, and there are illuminated water lilies on the pond, together with swans and ducks. Over twelve miles of main streets are decoratively lighted. The whole of the work has been carried out under the direction of Mr. F. N. Rendell-Baker, borough electrical engineer.

**Improved lighting on Aberystwyth promenade**

**Douglas (I.O.M.).**—ELECTRIC-DISCHARGE LIGHTING.—The Onchan Village Commissioners have requested the electrical engineer to replace twelve filament lamps by the electric-discharge type and to erect three extra lamps in the district.

**Dartford.**—EXTENSIONS.—The Electricity Committee has obtained sanction to borrow £2,217 for a low-voltage a.c. supply along Dartford Road.

HOUSE WIRING.—The Rural District Council has agreed to proposals submitted by the West Kent Electric Co. with regard to electrical installations in Council houses. Electricity is to be supplied for a weekly payment of 1s., plus 1d. per kWh. The Council is to undertake the collection of the weekly charge, for which service it will receive 5 per cent. commission.

**Dorchester.**—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £1,200.

HIRE SCHEME.—A scheme has been passed by the Electricity Committee under which electrical appliances will be hired to consumers.

LOANS.—Sanction is being sought to the borrowing of £3,000 for mains and services and £3,000 for consumers' apparatus.

**Glasgow.**—ART GALLERY LIGHTING.—The Art Galleries and Museums Committee has agreed to the provision of a new system of electric lighting at Kelvingrove Art Galleries, and specifications are to be prepared.

**Hastings.**—SUPPLY EXTENSION.—A supply of electricity is to be given by the Electricity Committee to sixty-three houses to be erected on the Baldslow Down estate.

**Irish Free State.**—PROPOSED LEGISLATION.—The text of the new Local Authorities (Electrical Employés) Bill, which has been circulated to members of the Free State Dail, states that it is "an Act to make special provision in relation to the superannuation rights of employés of a local authority who were transferred by statute to the Electricity Supply Board and subsequently return to the service of such local authority or its successor." Provision is made to ensure that where a person formerly employed by a local authority has been transferred under the Electricity (Supply) Act, 1927, to the services of the Electricity Supply Board and again returns to the service of the local authority such person's rights of superannuation are preserved. The service in the employment of the Electricity Supply Board is to be reckoned for the purpose of superannuation provided it has been continuous. Similarly, in the calculations of allowance of gratuity such continuous service under the Board must be taken into account.

**London.**—FULHAM.—The Electricity Committee is to afford a supply of electricity to the premises of the Limmer and Trinidad Lake Asphalt Co., Ltd., at Mead Wharf, Carnwath Road, at a cost of £1,408. A supply is also to be given to the Colloid Rubber Co., Burlington Road, at a cost of £340.

A sub-station is to be built in Munster Road at a cost of £1,862, and the cable system modified at a cost of £2,242.

**Oswestry.**—EXTENSION.—The Town Council is to afford a supply of electricity to Council houses at Carreghofa, Llanymynech.

**Redcar.**—LOANS.—The Electricity Committee has obtained sanction to borrow £4,500 for meters and services.

CHEAPER ELECTRICITY.—A two-part tariff has been recommended as an alternative to the flat rate. For domestic premises it will be 1⅝ per cent. of the rateable value, plus ¼d. per kWh, while for business premises £10 per kW of maximum demand is to be charged, with a running charge of 1d. per kWh.

**Switzerland.**—TRANSFORMING PLANT.—The Ateliers de Secheron, of Geneva, has completed three transformers for the new Chandoline power station of the Société La Dixence in the Valais Canton. A feature of the equipment is that it is designed to receive power from two sources, one at 13,000 V and one at 65,000 V, stepping it up to 130,000 V.

**Taunton.**—EXTENSION TO VILLAGES.—Mr. L. V. Turner, the borough electrical engineer, recently addressed a public meeting of residents of Florey and Bagborough. A résolution was afterwards passed in favour of a supply of electricity being given to the villages by the Corporation, and a committee was set up to canvass the districts.

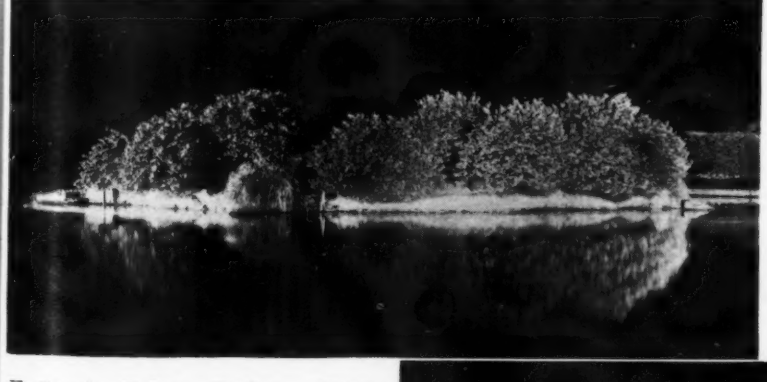
**Uttoxeter.**—LOANS.—The Urban District Council is to make application to the Electricity Commissioners for a loan of £12,600, made up as follows: £8,300 for mains and services, £1,200 for meters, £500 for assisted wiring, £2,000 for hire of appliances and £590 for switchgear and sub-stations.

**Watford.**—LOANS.—Sanction has been obtained by the Electricity Committee to loans of £5,000 for lighting in the extended area and £70,000 for mains and services, sub-stations and meters.

**Weymouth.**—EFFECT OF THE GOVERNMENT'S DISTRIBUTION PROPOSALS.—At a recent meeting of the Town Council it was reported that the I.M.E.A. had forwarded a copy of the confidential memorandum setting out the main outline of the Government's proposals in connection with the McGowan Report. The town clerk said that the memorandum meant that the Weymouth undertaking would be swallowed up by another. It was just a question of negotiation, and how much the Corporation would get was also a matter of negotiation.

EXTENSION.—Application is being made to the Electricity Commissioners for approval of a scheme for an extension of electricity supply in the western area and East Lulworth.

**West Hartlepool.**—OPPOSITION TO GOVERNMENT PLAN.—The Town Council at its monthly meeting decided to oppose the Government's plan to set up an electricity distributing authority to control an area from Whitby to Amble (Northumberland). The Council contended that such an authority would be outside the control of the local Councils concerned. The Council decided to support the formation of a joint electricity board to control the areas of Middlesbrough, West Hartlepool, Redcar, Stockton, Eston, Guisborough, Skelton and Brotton, and Whitby and other local authorities in the area which are at present supplied with electricity by the North-Eastern Electric Supply Co., Ltd.



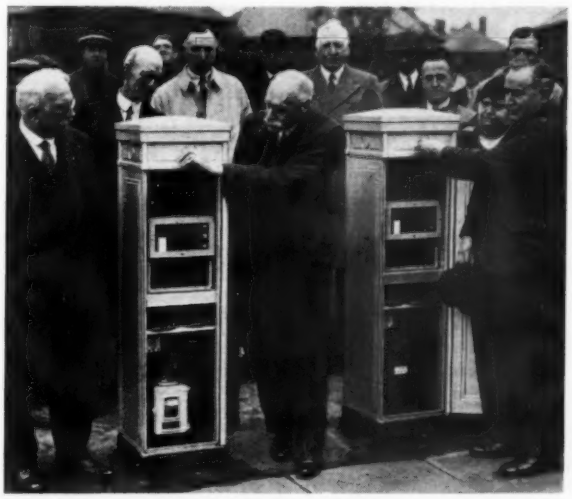
**Wolverhampton.**—MAINS EXTENSIONS.—The Electricity Committee is to extend its mains to housing estates at Heath Town at a cost of £938, Springfield (£818) and Warstones (£1,124).

# Traction

**Argentina.**—ELECTRIC ROLLING STOCK.—The administration of the State Railways has been authorised to purchase forty-two "Ganz" motor coaches.

**Huddersfield.**—TROLLEY-BUS DEPOT.—At its meeting last week the Town Council approved an estimated expenditure of £56,000 for the construction of a trolley-bus depôt at Longroyd Bridge.

**Liverpool.**—LIGHT-RAY TRAFFIC SIGNALS.—The official switching-on was recently performed of a system of "Electro-matic" light-ray traffic signals installed at the junction of Muirhead Avenue and Queen's Drive. The intersection is possibly one of the most complex in the North of England, for both Queen's Drive and Muirnead Avenue are double main roads, while two minor roads join them and a double tramcar track runs down the centre of Muirhead Avenue. At the present stage of development light-ray detection is suitable for use only where roads carry "one-way" traffic or where islands are placed in the roadway to separate the traffic into "one-way" streams. Light-ray detectors shine across the carriageway at two points on Queen's Drive and two points on Muirhead Avenue in advance of the intersection and across each roadway of Queen's Drive from the island in the centre. These last two detectors are necessary because the double roads which form Muirhead Avenue are situated at some distance from each other, and consequently traffic along Queen's Drive after crossing one roadway requires detecting again before it can safely be allowed to cross the other roadway. The light-ray detectors each consist of a transmitter directing a beam of light on to a receiver unit which incorporates a photo-electric cell. The beam is at a height of approximately 3 ft. above the surface of the roadway. The controllers and signal lanterns are of the standard "Electro-matic" pattern, and standard overhead traction-wire detectors of the same make are used for the tramcars. The installation is the result of close co-operation between the Ministry of Transport, the Liverpool Health Committee, officials of the City Engineer's Department, and the Automatic Telephone and Electric Co., Ltd., which has manufactured the whole of the equipment.



**Inaugurating the light-ray traffic control system at a Liverpool road junction**

**London.**—BUS STRIKE AND THE TRAMWAYS.—Up to our going to press efforts were still being made by London busmen to persuade tramway employés of the London Passenger Transport Board to join in the strike in support of the busmen's demand for a 7½-hour working

**Two good examples of illumination carried out for the Coronation:—Top: Egerton Park island, Bexhill, floodlighted by three projectors (total 2 kW). Bottom: Piccadilly Gardens, Manchester**

day. To this end a deputation of the Busmen's Committee attended a meeting of the Tramways Council. It was decided to convene a conference of delegates from all branches of the tramway and trolley-bus men.

HEAVY TRAFFIC.—It is stated that nearly 20 million passenger journeys were made on the Underground railways of the London Passenger Transport Board during Coronation week.

**South Shields.**—TUBE RAILWAY.—It is understood that a Bill may be promoted in Parliament in the autumn for the construction of a £400,000 Kearney high-speed tube railway under the Tyne, joining the North and South Shields railway stations of the L.N.E.R. The promoters are Arthur Whitley, Ltd., of London. Copies of the draft Bill, together with plans and sections of the proposed construction, are now in the hands of the Tynemouth and South Shields Corporations. Arrangements are being made to convene a joint conference of the two local authorities to discuss the scheme. The tube would be used for passengers only and would accomplish the journey between North Shields and South Shields in one minute. The Minister of Transport some time ago refused to support a scheme by the South Shields and Tynemouth Corporations for a road tunnel under the Tyne.

**Sunderland.**—TRAMS FAVOURED.—The view that the trams would provide the best transport service for the public for many years yet was expressed by the Mayor of Sunderland (Alderman T. Summerbell), speaking at the opening of another section of tram route in the town. The route extends for three-quarters of a mile from the old terminus at the Blue Bell Hotel, Fulwell, through Dene Lane to Dykelands Road to the sea front at Seaburn. The cost was £16,000. Opening the route, the Mayor said Sunderland had one of the cheapest tram services in the country. Trolley-buses cost 1.04d. a mile (as compared with ¾d. for trams) and their introduction would involve an increase in fares of 30 per cent. The Sunderland Council, it was announced, proposes to extend the tram route in Durham Road, Ford Estate, Grangetown, Hylton Road and Southwick.

**United States.**—ELECTRIC DRIVE AND DIESEL ENGINE FOR BUSES.—The fact that electric drive for motor buses in heavy city traffic continues to be a desirable as well as a practical development was demonstrated conclusively at the recent meeting of the Southern Transit Equipment Men's Association in New Orleans, states *Mass Transportation*. Speaking on this subject, Mr. G. W. Wilson, of the American General Electric Co., mentioned that the increased work for bus drivers was an important factor for consideration in the operation of heavy-duty city-type buses. Also, passengers demanded smoother and quieter operation. This had brought about renewed interest in automatic transmissions for buses, and with the advent of successful operation of the automotive Diesel engine it was natural that electric drive should again receive increased attention. In this connection Mr. Wilson called attention to the outstanding fact that electric drive was the only fully automatic transmission that had successfully survived the test of time and distance in heavy traffic. For these reasons the American General Electric Co. had recently introduced completely new electric transmissions which marked a real advance. Weight had been reduced by 35 per cent., allowing for the use of a standard axle and the elimination of the flywheel. Overall efficiency had been improved. Twenty-seven of these new electric drives were in service in Newark on 36-passenger buses with Diesel engines; ten were in service at Baltimore on 41-passenger coaches with Diesel engines; one of the latter type in Boston; and others were now on order for early test and use.

# Communications

**Bahamas.**—RADIO.—A new broadcasting station has been inaugurated at Nassau.

**Cuba.**—RADIO INTERFERENCE CONFERENCE.—The *Telegraph & Telephone Age* reports that invitations to an international radio conference to be held in Havana, Cuba, beginning November 1st, are to be sent, as a result of a resolution approved by the Cuban Cabinet, to all Central and South American countries and to Mexico, Canada, and the United States. The discussions will be based on agreements reached by Cuba, Mexico, the United States and Canada during their recent regional radio conference. It is hoped, says our contemporary, that the conference in November will be able to solve the radio problems of the Western Hemisphere.

**Great Britain.**—CORONATION TELEVISION.—The Coronation procession was seen by television at considerable distances from London and numerous messages of congratulation have been received at Alexandra Palace, states the British Broadcasting Corporation. A Brighton resident had an audience of sixty people to see the procession on two cathode-ray tubes operated by one receiver, while a report from Ipswich indicates that both sound and vision were received perfectly. A viewer at Fleet, Hants, thirty-seven miles away, saw the procession well, and good reception is reported from Rochester. It is stated that in South London reception was as perfect as at Alexandra Palace and Broadcasting House. At the Odeon Cinema, Southgate, one hundred people saw the procession by television. Elaborate plans were made by the General Electric Co. and their dealers throughout the television area to take full advantage of the televising of the Coronation procession. It is estimated that about 35,000 people looked-in on G.E.C. sets alone in 200 viewing rooms, drill halls and other buildings.

EXTENSION OF BROADCASTING HOUSE.—Within the next year Broadcasting House, the headquarters of the B.B.C., is to be extended. The new building will be on the site of a row of houses in Portland Place, and will be designed by Messrs. Val Myer and Watson-Hart and Messrs. Wimperis Simpson and Guthrie, in association with the B.B.C.'s civil engineer, Mr. M. T. Tudsbery.

**Japan.**—THREE MILLION RADIO LISTENERS.—A *Reuter* report from Tokio states that special programmes were radiated last Friday to celebrate the fact that the number of radio licences in force had reached 3,000,000. The broadcasting service in Japan was started twelve years ago.

**Russia.**—TELEVISION.—It is reported in the *Daily Telegraph* that apparatus for television in Moscow is being purchased in London. After the visit of a technical delegation to the Campden Hill, W., laboratories of Scophony, Ltd., the Soviet Government has ordered transmitting and receiving equipment. Two types of receiver, it is stated, have been purchased, one giving a picture 24 in. by 22 in. for home reception and the other a picture 5 ft. by 4 ft. for public viewing. The Moscow transmitter, which will broadcast films, will, it is understood, produce pictures of similar definition to those now transmitted from Alexandra Palace.

**Unusual lighting is a feature of the stations on the new Smolensk Square-Kiev extension of the Moscow underground railway. The right-hand illustration shows a train leaving the Dzerzhinski Square station**

**Yugoslavia.**—NEW TRANSMITTER.—A new Marconi 20-kW transmitter is shortly to be installed at Radio-Belgrade. The existing Marconi equipment (2.5 kW, Type Q) has been in continuous service for eight years. The technical report just issued shows that it was transmitting for 3,823 hours last year, and in that time programme interruptions due to technical defects amounted to 15 minutes, while valve replacements accounted for 50 minutes lost time.

# Contract Information

**Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses**

## Contracts Open

**Barking.**—May 24th. Borough Council. Electrical installations in flats and houses in Ripple and Abbey Roads. (May 7th.)

**Barnoldswick.**—May 31st. U.D.C. Electricity Department. Sheet steel kiosk, complete with transformer, and poles and steel work for 6.6-kV line. (See this issue.)

**Barrow-in-Furness.**—June 14th. Gas and Water Committee. Two electrically driven multi-stage centrifugal pumps (75-gal. per minute each against a head of 140 ft.) with automatic switch and control gears, &c. Engineer and manager, Gas and Water Department, Salthouse Gasworks (deposit £1 1s.).

**Birmingham.**—June 7th. Electric Supply Committee. Cable jointing compound for one year. (See this issue.)

**Blackpool.**—June 8th. Electricity Department. 6.6-kV switchgear, modifications at two cubicles, and one portable oil filter plant for transformer and switch oils. (May 14th.)

June 22nd. Borough Council. Electrically driven passenger lift (to carry twenty-five persons), in the North Shore lift tower. Borough Surveyor's Office, Municipal Buildings, Talbot Square (deposit £1).

**Bredbury and Romiley.**—June 7th. U.D.C. Electricity Department. L.v. and h.v. p.i. cables for the period ending April 30th, 1938. (See this issue.)

**Coseley.**—May 27th. U.D.C. Electrical wiring installation at the new Maternity and Child Welfare Centre and Minor Ailments Clinic. J. C. Roper, clerk to the Council, Council House.

**Croydon.**—June 9th. Electricity Department. Stores and materials for twelve months.—(See this issue.)

**Dartford.**—May 29th. Borough Council. Cast-iron lamp columns, brackets and reflectors and time switches. (May 14th.)

**Doncaster.**—May 28th. R.D.C. Renovating the internal wiring installations in houses at Edlington. Surveyor, Nether Hall.

**Eccles.**—May 31st. Electricity Supply Committee. Single-phase a.c. house service and prepayment meters for twelve months. Borough electrical engineer, Electricity Offices, 1, King Street.

**Edinburgh.**—May 28th. Corporation. Rewiring of the electric lighting installation in the Nurses' Home, Colinton Mains Hospital. City architect.

**Edmonton.**—May 24th. Education Committee. Eletric lighting at Eldon Road school. W. L. Brown, director and secretary, Education Offices, Brettenham Road (deposit 10s.).

**Egypt.**—CAIRO.—June 15th. Ministry of the Interior. Equipment for the electrification of the Zagazig drainage section. (T.Y. 31370.)*

June 16th. Ministry of Finance. Centrifugal and transportable irrigation pumps. (T.Y. 2576.)*

**Fareham.**—May 27th. U.D.C. Borehole type, electrically driven centrifugal pumps, with the necessary switchgear, at the Maindell pumping station. Taylor & Wallin, 1, Saville Place, Newcastle-upon-Tyne (deposit £13).

**Finchley.**—May 31st. Education Committee. Rewiring the electrical installation at the Alder Council school. C. R. Westlake, borough electrical engineer, Squires Lane, Finchley, N.3 (deposit £1).

**Galston** (AYRSHIRE).—May 26th. Town Council. Electric lighting work at 198 houses. T. C. Stewart, Clydesdale Bank Chambers, Kilmarnock.

**Great Crosby.**—May 31st. U.D.C. Four electrically driven centrifugal pumps of 1,850-cu. ft. per minute capacity, with ancillary plant, &c. Howard Humphreys & Sons, 17, Victoria Street, London, S.W.1 (deposit £5 5s.).

**Hemel Hempstead.**—May 24th. R.D.C. Wiring for electric lighting at thirty houses. Surveyor, Broadway Offices.

**India.**—SIMLA.—June 5th. Stores Department. Cable for one year. (T. 31363.)*

MADRAS.—June 14th. Electricity Department. Poles, conductors, insulators, &c., for 11-kV feeder lines. (T.Y. 31376.)*

June 28th. Equipment for construction of 66- and 33-kV substations, including transformers, switchgear, control and metering cubicles, storage battery apparatus, recording voltmeters, &c. (T. 31379.)*

**Inverness.**—June 2nd. Town Council. Electric lighting works in 100 houses at South Kessock. W. Smith, architect, 52, High Street.

**Irish Free State.**—DUBLIN.—June 15th. Electricity Supply Board. One 10,000-kVA transformer, with on-load tap-changing equipment. (May 7th.)

June 26th. Boiler plant and auxiliaries at the Pigeon House generating station. (See this issue.)

**Lancashire.**—June 5th. County Council. Electrical installation at the Senior Council school, Ormskirk. Particulars from S. Wilkinson, county architect, County Offices, Preston (deposit £2), by May 22nd.

**London.**—ST. MARYLEBONE.—May 25th. Borough Council. 11-kV metal-clad switchgear. (May 7th.)

ACTON.—June 4th. Town Council. Installation throughout the borough of a fire alarm and ambulance call bell system in connection with the erection of a new fire station. H. C. Lockyer, town clerk, Municipal Offices, Acton, W.3.

METROPOLITAN WATER BOARD.—July 1st. Two sets of electrically driven centrifugal pumps at the Hammersmith pumping station. Chief engineer, Room 235, Offices of the Board, 173, Rosebery Avenue, E.C.1 (deposit £2 2s. to the Comptroller of the Board).

EALING.—June 2nd. Borough Council. Electrical materials for twelve months. (See this issue.)

HAMMERSMITH.—June 11th. Borough Council. E.h.v. and h.v. switchgear. (See this issue.)

STOKE NEWINGTON.—June 1st. Borough Council. Rising mains in four blocks of floats.—(See this issue.)

**Manchester.**—June 4th. Electricity Committee. Pipework for fire pump, &c., and stand-by ash handling plant and modifications to gravity bucket coal conveyors at the Barton power station. (See this issue.)

**Middlesex.**—June 21st. County Council. Electrical installation at the new elementary school, Hibbert Road, Harrow Weald. (See this issue. )

**Monifeith.**—June 7th. Town Council. Electric lighting installation at housing estates. C. A. Mackenzie, burgh surveyor.

**New Zealand.**—WELLINGTON.—June 14th. Post and Telegraph Department. Insulated copper wire. (T.Y. 31349.)*

June 22nd. Telephone cords. (T. 31368.)*

July 6th. Public Works Department. 110-kV and 66-kV outdoor switchgear and steelwork. (T.Y. 31347.)*

July 13th. Electrical testing equipment. (T.Y. 31355.)*

June 29th. Filter presses and oil testing sets. (T.Y. 2574.)*

**Northern Ireland.**—BELFAST.—May 31st. Electricity Committee. Coal for twelve months at the Harbour power station. (See this issue.)

May 25th. Tramways Committee. Trolley-bus overhead line equipment for the Falls Road route. General manager and engineer, Corporation Tramways, Sandy Row (deposit £2 2s.).

**Nottingham.**—June 8th. Electricity Committee. General stores for twelve months. (May 14th.)

**Salford.**—May 25th. City Council. Three sets of vehicle-actuated type road signals. City Engineer's Office, Town Hall.

**Scunthorpe.**—May 24th. Borough Council. Duplicate centrifugal pumps, electric motors and automatic switchgear for a new sewage pumping station on the Lodge Farm estate. W. Farrar, borough engineer and surveyor, Council Offices (deposit £1).

**Shropshire.**—May 31st. County Council. Electric power plant, comprising transformer and four motors (aggregating 132 h.p.), lighting, &c., at the Council's quarry, Nills Hill, Pontesbury. W. H. Butler, county surveyor, County Buildings, Shrewsbury (deposit £2).

**Siam.**—June 15th. Department of Municipal and Public Works. Diesel electric generating plant. (T.Y. 31384.)*

**South Africa.**—JOHANNESBURG.—June 19th. City Council. Electric lamps for twelve months, including lamps for street lighting. (T. 31343.)*

June 12th. Street lighting lanterns. (T.Y. 31365.)* 5,000 30-A and 1,000 100-A cut-outs for pole mounting. (T. 31383.)*

June 16th. Electric cables with sealing, terminal end and trifurcating boxes. (T. 31371.)*

PORT ELIZABETH.—June 10th. Municipality. Electric lighting fittings and plug and switch units for the Elizabeth Donkin Infectious Diseases Hospital. (T. 31374.)*

**Southampton.**—May 24th. Electricity Department. One 15,000-kVA, one 5,000-kVA and one 7,500-kVA transformers, switch kiosk and 33-kV switchgear. (May 14th.)

**Swindon.**—May 28th. Electricity Department. Transformers, switchgear, extensions to 6.6-kV switchboard, alterations to 6.6-kV cubicle in kiosk sub-station and an outdoor kiosk-type sub-station. (May 7th.)

**Wolverhampton.**—June 29th. West Midlands Joint Electricity Authority. Cables. (May 14th.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

## Contracts Closed

**Aberdeen.**—Housing Committee. Accepted. Electric lighting at Middlefield housing estate (£513).—Stroud & Weir.

**Annan.**—Town Council. Accepted. Electric lighting installations for the Newington Road housing estate (£340).—D. M'Larty & Co.

**Barrow-in-Furness.** — Electricity Committee. Accepted. Twenty-eight disconnecting boxes (£295).—Henley's. Street lamps (£86).—Revo Electric Co. Supplies for twelve months: Cookers.—Revo Electric Co.; Hotpoint Electric Appliance Co.; English Electric Co.; Tricity Cookers, Ltd. Cables.—Britannic Cable and Construction Co.; Derby Cables, Ltd.; B.I. Cables. Poles.—Armstrong, Addison & Co. Meters.—Chamberlain & Hookham; Landis & Gyr; Met.-Vick. Elecl. Co.; Measurement, Ltd. Disconnecting boxes.—B.I. Cables.

**Blackpool.**—Electricity Committee. Accepted. Switchboard modifications.—Switchgear & Cowans. Meters for twelve months.—Aron Electricity Meter; British Electric Meters; Ferranti, Ltd.; Landis & Gyr; Measurement, Ltd.; Met.-Vick. Elecl. Co.

Transport Committee. Accepted. Mercury arc rectifier.—Hewittic Electric Co.

**Dingwall.**—Town Council. Accepted. Electrical work at forty-four houses.—Finlayson & Fraser.

**Eastbourne.**—Town Council. Accepted. Cable ducts.—Albion Clay Co. Cast lamp standards, brackets and lanterns.—Revo Electric Co. Steel poles.—Bromford Tube Co. Lanterns. —Electric Street Lighting Apparatus Co. L.v. joint boxes.—Callender's; B.I. Cables. L.v. pole boxes, overground disconnecting boxes, cut-outs and fuses.—W. Lucy & Co. Cables.—H. C. Rowland & Co.; Craigpark Electric Cable Co.; Standard Telephones; Mersey Cable Works. Switchgear.—Ferguson

Pailin. Wood poles.—F. Fryer. Cable slabs.—L. G. Ford. Cookers.—Jackson Electric Stove Co.; G.E.C. Cooker control units.—M.K. Electric. Kettles.—Bulpitt & Sons. Switch-fuses.—G.E.C. Compound.—Callender's; Dussek Bitumen Co. Wiring for hired and hire-purchase apparatus.—Cross Hasdel & Kirtland; K. R. Matthews. Assisted wiring.—K. R. Matthews. Transformers.—British Electric Transformer Co.; Hackbridge Construction Co. Meters.—English Electric Co., British Sangamo Co.; Met.-Vick. Elecl. Co.

**Folkestone.**—Town Council. Accepted. Internal and external wiring of houses and flats on the Canterbury Road housing estate (£3,448).—C. Slack (Mansfield, Notts).

**Glasgow.**—Police Committee. Accepted. Electrical fittings and accessories.—British Electrical & Manufacturing Co.; W. Geipel; G.E.C.; Revo Electric Co.

Public Assistance Committee. Accepted. Wireless installation at the Barnhill Institution (£1,512).—G.E.C.

Transport Committee. Accepted. Supplies in connection with the construction of 100 new tramcars: Lighting fittings.—T. Scott & Co. Heaters.—Unity Heating Co. Ventilators.—Anemostat (Scotland), Ltd. Reconditioning of underground rolling stock: Air brakes.—Westinghouse Brake & Signal Co. Handbrake gear.—R. Y. Pickering & Co. Motor equipments.—G.E.C.

**Great Yarmouth.**—Town Council. Accepted. Extension of the switchboard at the power station (£9,982).—English Electric Co.

**Hastings.**—Housing Committee. Recommended. Electrical installations at fifty-two houses at Broomgrove (£273).—S. H. Chapman.

**London.**—FULHAM.—Electricity and Lighting Committee. Recommended. Two bore-hole pumps, driving motors and starting gear in connection with the river water required for the make-up supply to the sulphur extraction plant, the make-up feed to the boilers, the cooling of bearings and other auxiliary services at the new power station (£1,125).—Mather & Platt, Ltd. Two 500-kVA transformers in connection with the increased supply to Hammersmith Distillery (£598).—Hackbridge Construction Co. Cable required for the Hammersmith Distillery scheme (£1.005).—Hackbridge Cable Co.

Accepted. Two 1,500-kVA Scott connected transformers for the extension of the Fulham Cross sub-station (£1,520).—British Electric Transformer Co.

**Middlesbrough.**—Town Council. Accepted. Circuit-breakers.—English Electric Co. Transformers.—Electric Construction Co.

**Newcastle** (STAFFORDSHIRE).—Town Council. Accepted. Electric lighting in 173 houses and bungalows at Cross Heath (£1,250).—W. Trusswell & Son.

**Northern Ireland.**—BELFAST.—Corporation. Accepted. Electric service lift in Belfast Castle (£347).—Pickerings, Ltd. Electric lighting installation at the Forth River P.E. school (£127).—J. J. & R. McCloskey.

**Northumberland.**—County Council. Accepted. Automatic telephones and central fire alarms in the Mental Institution, Northgate.—Automatic Telephone Co.; Devereux, Moodie & Co.

**Wakefield.**—Housing Committee. Accepted. Wiring ninety-eight houses on the Eastmoor estate.—H. Smith.

**Wolverhampton.**—Electricity Committee. Accepted. 230 sets of 60-A cartridge type fuse carriers (£431) complete with cast-iron covers, to fit existing boxes, and 150 sets of 100-A fuses (£412).—Revo Electric Co.

# Forthcoming Events

**Institution of Electrical Engineers** *(Scottish Centre).*—Friday, May 21st. Training College Hall, Dundee. 7.30 p.m. Joint meeting with the Dundee Sub-Centre. Faraday Lecture. "Electricity in the Hospital." Mr. R. S. Whipple. Saturday, May 22nd. Excursion to Taymouth Castle Hotel.

*Western Centre.*—Friday, May 21st to Monday, May 24th. Hotel Metropole, Minehead. Summer meeting.

*Wireless Section.*—Saturday, May 29th. Visit to the B.B.C. Television station, Alexandra Palace. Thursday, June 10th. Visit to the Television Exhibition, Science Museum, London.

*Transmission Section.*—Friday, June 18th, to Monday, June 21st. Visit to Holland.

**Association of Mining Electrical Engineers** *(South Wales Branch).*—Thursday, May 27th. 2.30 p.m. Visit to the Tir John power station. 5.30 p.m. Mermaid Hotel, Mumbles, Swansea. Annual meeting. Tuesday, June 22nd, to Saturday, June 26th. Southport. Annual convention.

**Association of Supervising Electrical Engineers** *(Manchester and District Branch).*—Saturday, May 29th. 3 p.m. Visit to the Hartshead generating station of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board.

**Incorporated Municipal Electrical Association.**—Monday, May 31st, to Friday, June 4th. Brighton. Annual convention.

**Electrical Contractors' Association of Scotland.**—Friday, June 4th, to Monday, June 7th. Peebles Hydro. Annual conference.

**British Standards Institution.**—Tuesday, June 8th. Dorchester Hotel, London, W.1. 12.45 for 1 p.m. Annual luncheon.

**Diesel Engine Users' Association.**—Wednesday, June 9th. Crewe. Summer meeting.

**Tramways, Light Railways & Transport Association.**—Wednesday, June 9th, to Saturday, June 12th. Edinburgh. Annual congress.

**Institution of Heating & Ventilating Engineers.**—Tuesday, June 22nd. Summer meeting.

**Electrical Contractors' Association.**—Wednesday, June 23rd. Llandudno. Annual conference.

**Illuminating Engineering Society.**—Thursday, June 24th, to Wednesday, June 30th. Paris. International congress.

# Notes

## Transmission Section Visit to Holland

The Transmission Section of the Institution of Electrical Engineers has arranged a week-end visit to Holland. The party will leave London on Friday evening, June 18th, and arrive back early on Monday morning, June 21st. A power station, sub-stations, testing laboratories, plant culture fields and rural electrification work, will be inspected. The cost of the trip will be £8 per person.

## The British Institute of Radiology

Since the publication in our last issue of a notice relating to the date of the annual general meeting of the British Institute of Radiology, incorporated with the Röntgen Society, we have learned from the Institute that the date has been changed from Thursday, May 20th, to Thursday, May 27th. The meeting will be held at the Reid-Knox Hall, London, and will commence at 6.30 p.m.

## Educational

A course of five lectures on "Electricity Meter Testing" will be given by Mr. G. F. Shotter at the Polytechnic, Regent Street, W.1, commencing on June 2nd. Another course of four lectures on "Television" will be given at the same institute by Mr. H. J. Barton Chapple, commencing on May 31st. The Studd lectures on industrial and commercial management will be given at the Polytechnic, Regent Street, W., on Fridays, from May 21st to June 11th. The first lecture is to be delivered by Mr. M. J. Railing (G.E.C.), whose subject will be "Personal Problems in Industrial Concerns."

## Blow Lamps and High-voltage Apparatus

In the *Industrial Safety Bulletin* is given an account of a fatal accident that occurred in curious circumstances. A blow lamp, spitting because it was not fully heated, was hauled up on a hand line into a sub-station structure. When the man in the structure took hold of the lamp handle and swung it round into position it shot out a stream of vapour and flame in the direction of a 66-kV bus-bar. There was a flash-back from the live terminal and two men were killed and a portion of the sub-station structure was wrecked. Later a blow lamp was tested under the same conditions and an arc approximately 36 in. long was produced.

## Aluminium Alloys

We have received a list of selected aluminium foundry alloys stocked by the Aluminium Union, Ltd., Bush House, London, W.C.2. Mechanical, chemical, physical properties and uses are set out, while alloys that comply with Air Ministry, Admiralty and other special specifications are indicated. For foundries which prefer to mix their own alloys the company supplies various hardeners or key metals and it also supplies alloys conforming to proprietary specifications or compositions.

## Appointments Vacant

The British Electrical Development Association has a vacancy for a man to be responsible for trolley-bus and electric battery vehicle development.

Head of the Department of Electrical Engineering and Physics at the Royal Technical College, Salford.

Stores and costing clerk for Settle and District Electricity Co., Ltd.

Editor for the Electrical Engineering Section of *Science Abstracts.*

Assistant mains engineer for Reigate Electricity Department.

Telegraph engineer for the Railway Department of the Government of Sierra Leone.

Surveyor and construction engineer for the Electricity Board for Northern Ireland.

Meter sales and service engineer for Smith Meters, Ltd.

Assistant in the Departments of Electrical Engineering and Mathematics, Dundee Technical College.

Mains assistant for Croydon Electricity Department.

Technical assistant for Port Elizabeth Electricity Department.

The commencing salary offered in connection with the posts of electrical engineers for the power station and mains department of the Calcutta Electric Supply Corporation, Ltd., advertised in our last issue (Supplement p. 12) is Rs.640 per month, not Rs.650 as printed.

(See our classified advertisements.)

# Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

Manufacturers of a 15-A s.p. kick switch, patents 312854 and 314146.

Readers should enclose stamped addressed envelopes when making their inquiries.

# Our Personal Column

**Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements**

On May 7th members of the Birmingham Electric Club visited the Rugby works of the British Thomson-Houston Co., Ltd., and the Hillmorton radio station, Rugby. The B.T.H. works were visited in the morning and the members were afterwards entertained to luncheon by the company. The accompanying illustration shows Mr. H. Hooper (president of the Club) in conversation with Mr. W. E. Clark (past-president) and Mr. R. H. Rawll.

**Mr. H. Hooper (president), Mr. W. E. Clark (past-president), and Mr. R. H. Rawll, of the Birmingham Electric Club, who with other members of the club recently visited the B.T.H. Rugby works**

**Dr. S. English,** D.Sc., F.I.C., F.Inst.P., has been elected president of the Illuminating Engineering Society for the ensuing session. Dr. English is a director of Holophane, Ltd.

**Mr. H. V. Potter,** B.Sc., managing director of Bakelite, Ltd., who has been elected a member of the Institution of Chemical Engineers, is sailing for the United States on May 29th and will be the official representative of the Society of Chemical Industry at the forthcoming semi-centennial meeting of the Engineering Institute of Canada at Montreal and later at Ottawa.

**Mr. S. Tillotson,** A.M.I.E.E., borough electrical engineer of West Hartlepool, was elected chairman of the Northern Counties Area of the British Electrical Development Association in succession to **Mr. S. G. Pike** at a recent meeting held in Newcastle. **Mr. W. A. Royle,** M.I.Mech.E., M.I.E.E., borough electrical engineer of Sunderland, was elected vice-chairman.

**Professor C. H. Desch,** D.Sc., F.R.S., F.I.C., was elected president of the Finsbury Technical College Old Students' Association at the annual meeting held on May 4th.

Among the promotions, transfers and appointments in the Colonial Service which have been announced are the following: **Mr. R. M. S. Dowling** (mechanical and electrical engineer, Public Works Department), engineer transport officer, Gold Coast; **Mr. R. H. Jones** (assistant electrical engineer, Federated Malay States), chief mechanical and electrical engineer, Public Works Department, Gold Coast; **A. W. Maile** (inspector, Telecommunications Branch, Post Office, British Guiana), telegraph inspector, Posts and Telegraphs Department, Gold Coast.

**Mr. S. Burns,** engineer in the mines department of the North-Eastern Electric Supply Co., Ltd., has relinquished his post in order to devote his time to other duties under the company. His post in the mines department has been taken by **Mr. N. S. Walker.**

**Mr. A. R. Hill,** electrical engineer of the Workington Iron and Steel Branch of the United Steel Co., has been elected president of the North of England Branch of the Association of Mining Electrical Engineers. Mr. Hill has always taken a keen interest in the work of the Association and was the founder of the Cumberland Branch. He is also a member of the Council.

**Mr. A. R. Hill**

**Messrs. J. E. Sherlock** and **W. F. F. Martin-Hurst** have been appointed joint managing directors of the British Thermostat Co., Ltd., consequent on the death of Mr. W. A. Payne. **Mr. F. G. Poplett** has been appointed an additional director and will continue as secretary.

**Mr. W. D. Brassington,** A.M.I.E.E., burgh electrical engineer, Motherwell, has been appointed chairman of the Scottish Centre of the Incorporated Municipal Electrical Association.

**Professor J. A. Crowther,** M.A., Sc.D., F.Inst.P., has been elected president of the British Institute of Radiology (incorporated in the Röntgen Society) for the session 1937-38.

## Obituary

**Mr. A. R. Holland.**—The death has occurred of Mr. Alfred Robert Holland, a director of the Midland Counties Electric Supply Co., at the age of eighty-six.

**Mr. W. A. Payne.**—We regret to announce the death of Mr. W. A. Payne, chairman and managing director of the British Thermostat Co., Ltd., which occurred on May 6th after a short illness, at the age of thirty-eight. Mr. Payne and his brother, Captain M. Payne, who died on February 6th last, were, with Mr. J. E. Sherlock, the founders of the British Thermostat Co., Ltd.

**Mr. A. F. Bennett.**—The death is reported of Mr. Arthur Frederick Bennett, F.R.A.S., M.Inst.C.E., a former director of Richard Garrett & Sons, Ltd., which occurred on May 15th, at Leiston, at the age of sixty-five. He was at one time general manager of Willans & Robinson, of Rugby, joining Richard Garrett & Sons in 1922, and later becoming a director.

**Dr. Ing. G. Merizzi.**—The death is reported from Milan, at the age of seventy-one years, of Dr. Ing. Giacomo Merizzi, a leading Italian electrical engineer.

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**Wills.—Mr. A. H. Morris,** a director of Buchanan & Curwen, electrical engineers, left £5,198 with net personalty £628.

**Mr. A. M. Sillar,** M.B.E., M.Inst.C.E., M.I.E.E., left £23,798 (net personalty £23,600).

# Financial Section

**New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares.**

## New Companies Registered

**Siemens-Schuckert Manufacturing Co. (I.F.S.), Ltd.**—Private company. Registered in Dublin, May 7th. Capital, £6,000. Objects: To carry on the business of engineers, electrical engineers, electricians, &c. The directors are: Rt. Hon. Lord Glenavy, "Clonard," 114, Kimmage Road, Terenure, Dublin, O. Mueller-Dubrow, "Summervill," Cross Avenue, Blackrock, Co. Dublin, and H. Broekhoven, 54, St. Albans Park, Sidney Parade, Dublin. Mr. Mueller-Dubrow and Mr. Broekhoven are directors of Siemens-Schuckert (Ireland), Ltd.

**Dorman & Smith (1937), Ltd.**—Private company. Registered May 8th. Capital, £21,000. Objects: To acquire the business of manufacturing electrical engineers now carried on by Dorman & Smith, Ltd. (incorporated in 1914). The directors are: T. Atherton, 16, Beresford Drive, Southport, J. N. Haworth, 40, Pilkington Road, Southport, R. Amberton, 32, Queen Victoria Street, E.C.4, and H. G. Baggs, 18, Chambres Road, Southport. Secretary: J. H. Bull. Registered office: Ordsal Electrical Works, Middlewood Street, Salford.

**R. H. Farmer, Ltd.**—Private company. Registered in Dublin May 5th. Capital, £1,000. Objects: To carry on the business of electricians, electrical and mechanical engineers and contractors, &c. The directors are: J. Farmer, 88, Hollybrook Road, Clontarf, Dublin, and three others.

**N.R.H.S. (Midland Counties), Ltd.**—Private company. Registered May 7th. Capital, £5,000. Objects: To acquire the goodwill of that part of the business carried on by Notts and Derby Radio Relays, Ltd., of 18, Market Place, Mansfield, through and by way of agency agreements with the National Radio Hire Service, of Vernon House, Friar Lane, Nottingham, namely, *inter alia*, the hiring out to the general public, through National Radio Hire Service, of wireless sets and

radio gramophones, including maintenance. The subscribers are: C. A. Garrett and F. Webb, both of 2, Bond Court, Walbrook, E.C.4. Solicitors: Linklaters & Paines, 2, Bond Court, Wallbrook, E.C.4.

## Returns of Electrical Companies

**Ensign Lamps, Ltd.**—The nominal capital has been increased by the addition of £82,000 beyond the registered capital of £18,000. The additional capital is divided into 328,000 ordinary shares of 5s. each. The 18,000 ordinary shares of £1 in the original capital have been sub-divided into 72,000 ordinary shares of 5s. The company has also been converted into a public company.

**Electrical Measuring Instruments Co., Ltd.**—Wm. J. G. Palmer, of 14, Gloucester Terrace, Hyde Park, was appointed receiver and manager on May 4th, 1937, under powers contained in debenture dated February 13th, 1937.

**George R. Lee & Co., Ltd.**—Louis Goldwyn, of 115, Park Street, W.1, ceased to act as receiver and manager on May 4th, 1937.

**R. Alger & Sons, Ltd.**—Charge on leasehold land and premises, No. 160, Dock Street, Newport, Mon (collateral to a debenture dated June 23rd, 1928), dated April 19th, 1937, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., not exceeding £12,500.

**Philco Eastern Distributors, Ltd.**—Capital, £500 in £1 shares. Return dated October 1st, 1936 (filed May 4th, 1937). All shares taken up. £500 paid. Mortgages and charges nil.

**West Witton Electric Supply Co., Ltd.**—Capital, £1,000 in £1 shares. Return dated May 4th, 1937. 885 shares taken up. £885 paid. Mortgages and charges nil.

**North Somerset Electric Supply Co., Ltd.**—The nominal capital has been increased by the addition of £100,000 in £1 ordinary shares beyond the registered capital of £600,000.

**Sterling Batteries, Ltd.**—The nominal capital has been increased by the addition of £24,000 in £1 ordinary shares beyond the registered capital of £1,000.

**Celestion, Ltd.**—Satisfaction in full on March 18th, 1937, of debentures dated April 1st, and September 4th, 1935, and registered April 9th and September 4th, 1935, securing £5,000 and £2,500 respectively.

**W. R. C., Ltd.**—Particulars filed of £2,400 debentures authorised January 22nd, 1937, charged on the company's property and assets, present and future, including uncalled capital, the whole amount being issued on April 24th, 1937.

**Sydney R. Hare & Son, Ltd.**—Capital, £3,000 in £1 shares. Return dated December 11th, 1936. All shares taken up. £3,000 paid. Mortgages and charges nil.

**Plymouth Rediffusion Service, Ltd.**—The nominal capital has been increased by the addition of £10,000 beyond the registered capital of £5,000. The additional capital is divided into 200,000 ordinary shares of 1s. each.

**M. C. Dizer, Ltd.**—John R. Sinclair, of Alexandra House, Kingsway, W.C.2, ceased to act as receiver and manager on April 14th, 1937.

**Anti-Attrition Metal Co., Ltd.**—The nominal capital has been increased by the addition of £20,000 beyond the registered capital of £80,000. The additional capital is divided into 200,000 ordinary shares of 1s. each.

**"Ros-Rol" Products Co., Ltd.**—The nominal capital has been increased by the addition of £1,500 beyond the registered capital of £3,000. The additional capital is divided into 30,000 ordinary shares of 1s. each.

**F. A. Laws, Ltd.**—The nominal capital has been increased by the addition of £500 in £1 ordinary shares beyond the registered capital of £1,000.

## City Notes

**E. K. Cole, Ltd.,** in their report for the ten months ended March 31st, state that the number of broadcast receivers sold is appreciably higher than that for the same period of last year, while the cash value of the turnover is slightly in excess. The reduced margin of profit under which the company is at present operating is reflected in the accounts. The net profits are £87,517, as against £182,025 for the preceding twelve months, to which is added £38,501 brought in. General reserve receives £25,000, and employés' fund £5,000. It is proposed to pay a final dividend of 17½ per cent. on the ordinary shares, making 30 per cent., for the period, equivalent to 36 per cent. per annum, and to carry forward £29,615. For the preceding year the distribution on the ordinary shares was 40 per cent.

# Electricity Production in Jugoslavia

### (By a Special Correspondent)

AMONG the Balkan countries Jugoslavia possesses the greatest hydro-electric potentialities, as will be seen from the following comparative figures of output of electricity:—

| | Bulgaria. | | Jugoslavia. | | Rumania. | |
|---|---|---|---|---|---|---|
| | Hydro-electric. | Steam and Diesel. | Hydro-electric. | Steam and Diesel. | Hydro-electric. | Steam and Diesel. |
| | | | (Millions of Kwh.) | | | |
| 1936 ... | 95 | 40 | 300 | 120 | 118 | 470 |
| 1935 ... | 90 | 42 | 289 | 115 | 122 | 460 |
| 1934 ... | 89 | 44 | 230 | 102 | 125 | 440 |
| 1933 ... | 80 | 47 | 220 | 110 | 120 | 430 |
| 1932 ... | 68 | 53 | 250 | 140 | 117 | 399 |

So far, however, only about 7 per cent. of Jugoslavia's available water power has been developed. The most important hydro-electric sources are found in the north-western part of the country (Drava district), in the central part (Drina district), and in certain coastal districts. Many of the principal rivers possess great potentialities, including the Danube in the Djerdap district. About 90 per cent. of the hydro-electric plant installed is in the Drava and coastal districts. In Western Jugoslavia the most important hydro-electric centre is the Fala plant at Maribor, built before the war by Swiss capitalists, and exploiting the waters of the Drava river. The output of this plant is between 170 and 180 million kWh annually. Two 8,700-kW sets have recently been installed, and distribution lines connect this centre to practically the whole territory of the Sava district.

In the coastal districts the most important hydro-electric plants are those of the Société Française des Forces Hydro-électriques de la Dalmatie ("La Dalmatienne"), near Sibenik, which were taken over from the Italian concern Sufid, and which exploit the waters of the rivers Krka and Cetina. The plant at the Kraljevac waterfall has been increased to 95,000 h.p. by recent extensions, and the transmission voltage has been raised to 80,000. The output of the Dalmatian plants averages now about 250 million kWh annually, but proposals have been made to raise it to 900 millions.

The international economic crisis, however, has influenced the position of the Jugoslav cement and calcium carbide industries, which are the principal customers of the Dalmatian water-power concerns. This militates against the extension of the hydro-electric plants; the contract between La Dalmatienne and the Jugoslav Government stipulates that the enlargement of the electric plants is subject to the construction of the new calcium carbide and cement factories. During the past two years, considerable attention has been given to proposals for the electrification of the Jugoslav railways, especially the narrow-gauge lines of Bosnia-Herzegovina. If this idea develops there is no doubt that the position of the Dalmatian hydro-electric industry might greatly improve.

In addition to these hydro-electric works Jugoslavia has important steam stations among which may be mentioned the Belgrade undertaking which supplies electricity to the Jugoslav capital and the neighbouring towns of Zemun and Pancevo; it has a capacity of 30,000 h.p. This concern is controlled by Swiss capital, while Austrian financiers (Niederoesterreichische Eskomptgesellschaft) are interested in the steam power stations in Central Serbia, the most important of which is the Kragujevac plant with a power of 15,000 h.p. In the course of the past few years Swedish interests, which control the steam electric industry in the Danube district, have been planning the building of a large steam station to enable the smaller plants to be closed down and thus reduce operation expenses. There are important steam stations at Zagreb and Karlovac; here, also, there is a tendency to amalgamate plants in order to cut down expenses. An example of this is the connection of the Valenj thermal plant with the Zavrsnica hydro-electric works. The high-voltage lines in the Drava and Sava districts have been considerably extended and some of them now reach the Hungarian frontier.

When it is considered that the consumption of electricity in Jugoslavia during 1936 was only about 600 million kWh against 460 million in 1931, it can easily be seen that not much progress has been made since the passage of legislation to hasten the electrification of the country. This situation is due especially to the fact that there has been severe competition by petrol engines which have been found more advantageous especially by the Jugoslav lumber industry, which is one of the most important factors in the economic life of the country, and to the influence of the cheapness of Jugoslav coal which has encouraged the use of steam plant. On the other hand, the exploitation of the existing hydro-electric resources, especially so far as Montenegro is concerned, and the construction of extensive high-voltage lines involve the investment of large amounts which have not been available in Jugoslavia owing to the international monetary crisis. The Jugoslav Government is now considering a revision of the existing legislation regarding electrification with a view to encouraging investment. Furthermore, Germany, under the provisions of the Jugoslav-German trade agreements, has made several offers in Belgrade with the object of encouraging the electrification of the country.

**The Calcutta Tramways Co., Ltd.,** held its annual meeting on May 11th, when Sir Geoffrey R. Clarke (chairman), who presided, reviewed the accounts and said that the increase in expenditure was chiefly due to the additional cost of maintaining and repairing the permanent way and cars, while that on the capital account during the past year was mainly represented by the building and equipping of additional substations for supplying electricity to the track and the provision of new rolling stock. This stock now included a hundred new cars in use, while a further thirty cars were on order. Their tramway system in Calcutta was insufficient in length for a city with a population of nearly 1,500,000 persons. They had applied for permission to extend their system along certain new roads, but this had been refused on the grounds that the Corporation desired all extensions to be made by trolley-bus services. Tramways still offered, in the company's opinion, the most suitable form of transport for the peculiar circumstances of Calcutta, but they were not blind to the demand for trolley-buses and intended to examine the possibility of adopting this method of transport. The amendment of their Tramway Act to allow the word "tramways" to cover trolley-buses had been agreed to by the Corporation, and recommended to the Government of Bengal, and it was expected that the necessary legislation would be passed in the course of the year.

**Siemens Bros. & Co., Ltd.,** report a profit for 1936 of £329,986, as compared to £220,690 in the preceding year, to which is added £339,724 brought in, making £669,710. General reserve receives £86,343, and it is proposed to pay a dividend of 7½ per cent. on the ordinary stock for the year (against 6 per cent.), leaving £344,617 to be carried forward. The report states that the general improvement in trade conditions has been notably marked in the electrical industry, and the company's workshops have been fully occupied throughout the year. The number of workpeople employed has exceeded the previous highest peak and it has been found necessary to make considerable extensions to buildings and plant. Meeting: May 21st.

**The Great Northern Telegraph Co., Ltd.** (of Denmark), reports that the traffic receipts and profit from participation in other telegraph undertakings for 1936 were £675,808, as compared with £714,483 for the preceding year, to which is added interest (£270,605), sundries (£58,660), and £484,990 brought in, making £1,490,063. From this is deducted a total expenditure of £605,314). The final dividend is 7½ per cent., plus a bonus of 7½ per cent., making 20 per cent. for the year (same), and £482,294 is carried forward.

**The West Devon Electric Supply Co.** reports a trading profit for 1936 of £19,830, as against £17,175 in the preceding year, to which are added dividends from subsidiary companies (£3,100), interest (£1,017), tax adjustment (£2,782), and £1,196 brought in, making £27,924. The ordinary dividend for the year is maintained at 5 per cent., less tax, and £1,332 is carried forward.

An extraordinary meeting was to be held at Tavistock on May 19th to consider a resolution increasing the capital to £450,000 by the creation and issue of 100,000 ordinary shares of £1 each.

**Pye Radio, Ltd.,** reports profits for the year ended March 31st of £127,600. It is proposed to pay the following final dividends:—On the participating preferred ordinary shares, 6 per cent., making 10 per cent. for the year; on the deferred ordinary shares a dividend of 125 per cent. It is also proposed that the deferred ordinary shareholders shall receive a capital bonus out of the undistributed profit by increasing the deferred ordinary shares of 1s. to deferred ordinary shares of 5s. each. The whole of the issued preferred and deferred shares are to be converted into stock.

**Ransomes, Sims & Jefferies** report a profit for the nine months to December 31st of £56,786. After providing for debenture interest, &c., and adding £36,643 brought in there is a total of £84,963 available. Special reserve receives £10,000, and the ordinary dividend is 4 per cent., less tax, being at the rate of 5⅓ per cent. per annum. The balance carried forward is £43,525.

**Veritys, Ltd.,** report a profit for 1936 of £20,925, as compared with £12,10[illegible] in the preceding year. From this are deducted directors' fees and (non-recurring) charges for debenture interest, &c., £7,462, and depreciation £3,000, leaving £10,463 to be carried forward. During the year the capital was reduced from £196,000 to £3,500 and a new issue was made. The present capital is £140,000, issued at a premium.

**The Brazilian Traction, Light & Power Co.** has declared a dividend of 50 cents a share on the issued ordinary shares of no par value. Payment to non-residents of Canada will be subject to deduction of the Canadian income tax of 5 per cent.

**The Dubilier Condenser Co. (1925), Ltd.,** is paying a final dividend of 10 per cent., making 20 per cent. (same).

**The Sphere Investment Trust** reports a net revenue for the year ended March 31st of £58,973, as compared with £46,641 for 1935-36. It is proposed to pay a dividend of 5 per cent. on the enlarged ordinary capital of £600,000 (against 4 per cent.), and to carry forward £17,453. It is proposed to increase the share capital from £1,200,000 to £1,400,000, but no immediate issue is contemplated.

**Broadcast Relay Service** is paying a final dividend of 5 per cent., making 10 per cent., less tax, for the year ended March 31st. For the previous year the interim dividend was 15 per cent., plus a scrip bonus of 200 per cent. This was followed by a final dividend of 5 per cent. on the enlarged capital.

**The Telegraph Condenser Co.** proposes to pay a dividend of 10 per cent. on the ordinary shares for 1936 (against 20 per cent. for 1935).

**The Cawnpore Electric Supply Corporation, Ltd.**—Presiding at the annual meeting held on Tuesday last Mr. K. A. Scott-Moncrieff (chairman), said that during 1936 they had spent £212,850 on various extensions, which included £167,212 on machinery and £34,439 on mains. They had laid fifteen miles of cable and installed additional switchgear, while they still had to make considerable expenditure under both these headings. Their present programme was almost completed, but the demand upon their supply continued to increase and it would probably be necessary to make still further additions to their generating plant and mains. The new plant was to be brought into operation in a few weeks. Last year the sales of electricity in kWh rose by 21 per cent. over those of 1935, and at the end of 1936 they had connected to their mains 32,376 kW of plant, against 25,654 kW in the previous year, a rise of 27 per cent. In Cawnpore their business was increasing very satisfactorily and looked like doing so for some time. Existing industries in this area were spreading, new industries were being introduced and they considered that their cheap supply of electricity had, in no small measure, contributed to this state of affairs.

**Edmundsons' Electricity Corporation** reports a trading profit for the year ended March 31st of £208,587, as compared with £196,693 in the preceding year, to which is added £589,564, representing dividends and interest, &c., received from its subsidiaries, making £798,151. After deducting debenture interest, &c., there is a net profit of £520,367, which, together with £49,720 brought forward from the preceding year's account, makes £570,087 available. Reserve receives £30,000 and the final ordinary dividend is 5 per cent., making 9 per cent. for the year (against 8 per cent.), the balance carried forward being £50,477.

**Tubelight Holders, Ltd.**—The nominal capital has been increased by the addition of £1,000 beyond the registered capital of £1,000. The additional capital is divided into 1,000 10 per cent. preference shares of £1 each.

**Telephone Properties, Ltd.,** is paying a dividend of 5 per cent. on the ordinary stock in respect of 1936. This compares with an interim of 2 per cent., and a final payment of 3 per cent., for 1935.

**The Metropolitan Electric Supply Co.** is issuing 350,000 £1 ordinary shares at 37s. 6d. each in the proportion of one for every eight held. The issue is being made to provide capital to liquidate loans and to take care of current requirements.

**Truphonic Radio, Ltd.**—The nominal capital has been increased by the addition of £5,000 in £1 preference shares beyond the registered capital of £6,000.

**Crabtree Electrical Industries, Ltd.,** has declared an interim dividend of 2½ per cent. for the half-year ending May 31st on the 5 per cent. cumulative preference shares.

**Ever Ready (Ireland)** is paying a final dividend of 7½ per cent., making 12½ per cent. for the year (against 7½ per cent.).

**Radio Rentals, Ltd.,** has announced an interim dividend of 5 per cent., actual, less tax, on the ordinary shares.

# Stocks and Shares

TUESDAY EVENING.

THE general condition of Stock Exchange markets can be summed up in the one word: Dull. To say "depressed" would be to exaggerate. To describe the House as being active would raise an ironical smile from anyone conversant with the present-day state of affairs. It is thought likely that next week, when Coronation rejoicings and festivities are over, there will be a chance for business to settle down into more normal conditions than it has had the opportunity of observing during the past few weeks. In view of the present listlessness and of the disinclination on the part of money to employ its capital in Stock Exchange avenues, the firmness of markets may be thought a little surprising.

## Edmundsons' Dividend

A higher distribution for the year on Edmundsons' Electricity Corporation ordinary shares had been indicated by the raising of the interim payment: the declaration of a final dividend making 9 per cent., as against 8 per cent. previously, was not, therefore, so unexpected as to make any difference to the price of the shares, which stand at 42s. Allowing for the dividend in the price, the yield is £4 7s. 4d. per cent., or a little above the average return obtainable in the electricity supply group. The present quotation compares with the price of 46s. at which the block of 800,000 "repatriated" shares was marketed a little over six months ago. Electricity supply shares in general continue to display the steadiness which has characterised the market throughout the past unsettled weeks. The latest Government move towards implementing plans for reorganisation of the industry is regarded as reassuring to the proprietors of shares in the leading companies. Metropolitans, at 48s., are quoted ex-rights to the new shares, which, issued at 37s. 6d., are changing hands at around 8s. 9d. premium.

## Electrical Equipment Shares

With activity restricted by a combination of circumstances both seasonal and technical, little of interest is passing in industrial markets. Prices of shares are inclined to sag through lack of support: buyers have reasons, apart from the holidays, for temporarily holding aloof. While not yet convinced that last month's liquidation is altogether at an end, people are, at the same time, distinctly chary about buying industrial equities while the N.D.C. formula is still thought to be in the melting pot. Electrical equipment shares have followed the general trend in losing a small part of the previous

fortnight's improvement. General Electrics, for instance, at 85s., are 1s. down. Associated Electricals lost a similar amount at 49s. 6d. Official announcement that Crompton Parkinsons have joined the E.L.M.A. had no particular influence on the price of the shares, which declined to 61s. 3d. in sympathy with the dullness elsewhere apparent.

### Transport Stocks

London Transport "C" stock, on the holders of which falls the brunt of the 'bus dispute, is inevitably fluctuating with the ebb and flow of hopes for an early settlement of differences. With a decline of 10s. on the week, the quotation remains depressed at 84. Apprehension continues to be occupied less with the actual costs of the stoppage than with the possibility of concessions to the men, and with the financial position disclosed during the inquiry. British Electric Traction deferred, in falling to 1450, lost part of the jump of 125 points which followed publication of the report. The price still includes dividend and bonus. A reaction in Thomas Tillings left the price 1s. lower, at 64s. Lancashire Transport gave way from 31s. to 29s.

### Brazilian Traction

The common shares of the Brazilian Traction Light and Power Company have lately felt the backwash of their popularity as a speculative counter in transatlantic and Continental stock exchanges. Had it not been for a persistence of liquidation in some of those centres, the price of the shares would have probably responded with more animation to the latest dividend declaration. The payment now proposed of 50 cents per share follows others of 40 cents in January and 30 cents in July of last year, previous to which had been a blank period of three years. On the latest announcement the shares rallied mildly to 22¾, but show, nevertheless, a small loss on the week. The recent collapse of prices caught Brazilian Tractions at the top of a steep rise; the price had mounted to over 20 on the strength of better trading conditions. These were reflected in the publication of current earnings. Also there has been an improvement in the exchange position, as witnessed by the ability of the company to pass on the resultant benefits, in cash, to overseas shareholders.

### Television

Interest in television shares has always been of a spasmodic order: during the last few months a lengthy period of apathy has been broken only by such events as the beginning of regular transmissions, and the selection of the Marconi-E.M.I. system for transmitting purposes. Conditions were not enlivened to any marked extent by the degree of success achieved in televising the events of Coronation Day, although some of the recent recovery in the price of General Electric shares was thought to have originated in anticipation of an increased public demand for receivers. E.M.I. shares, standing at a trifle over 20s., are rather out of favour. There is not much going on in Baird issues, which have failed to recover from the severe set-back they suffered at the time of the transmitting-system decision. The deferred are dealt in occasionally at about 2s., and the preferred at 1s. The denomination of each share is 2s. 6d. Scophony 5s. shares are equally quiet at 7s.; the company expects its new receivers to be available towards the end of the year.

### Radio

Publication, within a few days of each other, of the E. K. Cole and Pye companies' dividends and results drew attention to the switchback fortunes of companies engaged in the close competition of the radio industry. E. K. Cole report a reduction in profits despite a larger volume of trade, and have lowered this year's distribution to a rate equivalent to 36 per cent. per annum, as compared with 40 per cent. previously. The price of the 5s. shares has weakened to 19s. The Pye company's preliminary figures show a continued expansion of earnings; the dividend on the deferred capital is repeated at 125 per cent., and by way of a capital bonus to holders, the nominal value of the shares is to be raised from 1s. to 5s. At their present price of 16s. the deferred shares offer the buyer a return approaching 8 per cent. on the money. On E. K. Coles the yield is nearer 10 per cent. The company has, incidentally, through its holding in Scophony, an interest in the future of commercial television.

### Miscellaneous Matters

Cable and Wireless ordinary stocks turned reactionary, in keeping with the general trend of markets. The "A" has gone back from 27 to 25½, but the "B," at 6¾, recovered an earlier set-back. Interest in other communication stocks is directed mainly towards the transatlantic group, in which some sharp reductions typify the renewal of nervousness in overseas markets. American Telephones are 4 points lower at 166½. Internationals have fallen from 11¼ to 10¼, and Western Unions from 63 to 56. Canadian Marconis declined to 7s. 6d.

The rubber share market awaits, without enthusiasm, further details in regard to N.D.C. Business in rubber shares is quiescent. It is not stimulated by Germany's intention to raise the import duty in order to encourage experiments with synthetic rubber. Business in most of the Stock Exchange departments is, as already noted, of very scanty volume; the three weeks' Coronation account has brought but little grist to the mills of the markets generally.

## Share List of Electrical Companies

| | Dividend. Nom. | Previous. | Last. | Price. May 18. | Rise or Fall. | Yield. p.c. £ s. d. |
|---|---|---|---|---|---|---|
| **HOME ELECTRICITY COMPANIES** | | | | | | |
| Bournemouth and Poole | 1 | 15 | 15 | 73/9 | — | 4 1 9 |
| City of London | 1 | 7½ | 7½ | 35/0 | — | 4 5 9 |
| Clyde Valley | 1 | 7 | 8 | 43/– | — | 3 14 5 |
| County of London | 1 | 10½ | 10½ | 51/6 | — | 4 1 6 |
| Edmundson's 7% Pref. | 1 | 7 | 7 | 34/6 | +1/– | 4 1 2 |
| Do. Ord. | 1 | 8 | 9 | 42/0 | — | 4 5 9 |
| Elec. Dis. Yorkshire | 1 | 9 | 9 | 44/6 | — | 4 1 0 |
| Elec. Fin. and Securities | 1 | 12½ | 12½ | 2½ | — | 4 7 0 |
| Elec. Supply Corporation | 1 | 11 | 12 | 57/– | — | 4 4 3 |
| Lancs Light and Power | 1 | 7½ | 7½ | 35/– | — | 4 5 9 |
| Lond. Assoc. Electric | 1 | — | 7 | 33/3 | — | 4 4 2 |
| London Electric | 1 | 7 | 8 | 36/– | — | 4 9 0 |
| London Power Deb. Red. | Stock | 5 | 5 | 106½ | — | 4 14 0 |
| Metropolitan | 1 | 10 | 10 | 48/-xr | — | 4 3 4 |
| Midland Counties | 1 | 7½ | 8 | 40/– | — | 4 0 0 |
| Mid. Elec. Power | 1 | 8 | 9 | 2½ | — | 4 5 0 |
| North Eastern Electric Ordinary | 1 | 6 | 7 | 34/– | — | 4 2 4 |
| Do. 7% Pref. | 1 | 7 | 7 | 34/6 | — | 4 1 2 |
| Northampton | 1 | 10 | 10 | 48/9 | — | 4 2 0 |
| Notting Hill 6% Pref. | 10 | 6 | 6 | 14 | — | 4 5 9 |
| North Met. Elec. Ordinary | 1 | 10 | 10 | 50/– | — | 4 0 0 |
| Do. do. 6% Pref. | 1 | 6 | 6 | 31/– | — | 3 17 5 |
| Scottish Power | 1 | 8 | 8 | 40/– | — | 4 0 0 |
| South London | 1 | 7 | 7 | 32/– | — | 4 7 6 |
| Whitehall Elec. Invst. 7½% Pref. | 1 | 7½ | 7½ | 22/– | — | 6 16 5 |
| Yorkshire Elec. | 1 | 8 | 8 | 43/– | — | 3 14 5 |
| **PUBLIC BOARDS.** | | | | | | |
| Central Electricity, 1950–70 | Stock | 5 | 5 | 114 | — | 4 7 9 |
| Do. 1955–75 | „ | 5 | 5 | 115½ | — | 4 6 7 |
| Do. 1951–73 | „ | 4½ | 4½ | 110½ | — | 4 1 3 |
| Do. 1963–93 | „ | — | 3½ | 98½ | — | 3 11 1 |
| London Elec. Trans. Gtd. | „ | — | 2½ | 91 | — | 2 15 0 |
| London & Home Counties, 1955–75 | „ | 4½ | 4½ | 110 | — | 4 1 10 |
| London Passenger Transport, A | „ | — | 4½ | 117½ | — | 3 16 7 |
| Do. do. B | „ | — | 5 | 110½ | — | 4 5 10 |
| Do. do. C | „ | 4 | 4 | 84 | –½ | 4 15 3 |
| West Midlands Joint Elec. 1948–68 | „ | — | 5 | 112½ | — | 4 9 0 |
| **TELEGRAPH AND TELEPHONE.** | | | | | | |
| American Tel. & Tel. | $100 | 9 | 9 | 166½ | –4 | 5 8 1 |
| Anglo-Am. Tel. Pref. | Stock | 6 | 6 | 122 | +1 | 5 0 0 |
| Do. Def. | „ | 1½ | 1½ | 29 | — | 5 3 5 |
| Cable & Wireless 5½% Pref. | „ | 4½ | 5½ | 110 | — | 5 0 0 |
| Do. A. 7½% Ord. | „ | Nil | Nil | 25½ | –1½ | — |
| Do. B. Ord. | „ | Nil | Nil | 6¾ | — | — |
| Globe Tel. & Tel. Ord. | 10 | 3½* | 4½* | 16 | — | 2 16 5 |
| Do. do. Pref. | 10 | 6 | 6 | 14 | — | 4 5 9 |
| Great Northern Tel. | 10 | 20 | 20 | 43 | — | 4 13 0 |
| Marconi-Marine | 1 | 10 | 7½ | 1¾ | — | 4 5 9 |
| Oriental Telephone Ord. | 1 | 12* | 12* | 3½ | — | 16 10 |
| **HOME AND FOREIGN TRAMS, ETC.** | | | | | | |
| Anglo-Arg. Trams First Pref. | 5 | Nil | Nil | 7/– | — | — |
| Do. do. 2nd Pref. | 5 | Nil | Nil | 3/9 | — | — |
| Do. do. 5% Deb. | Stock | Nil | Nil | 22½ | — | — |
| British Electric Traction Df. Ord. | „ | 5 | 5 | 1450 | –50 | — |
| Do. do. Pref. Ord. | „ | 8 | 8 | 165 | — | 4 15 5 |
| Brazil Traction | $100 | 40 cts. | 50 cts. | 22¾ | –¼ | — |
| Brit. Columbia Elec. Rly. Pcs. | Stock | 5 | 5 | 104½ | — | 4 14 9 |
| Mexican Light Common | $100 | Nil | Nil | 3½ | — | — |
| Do. 1st Bonds | $500 | 5 | 5 | 42½ | — | — |
| Victoria Falls Ord. | 1 | 20 | 12 | 65/– | –½ | 3 13 10 |
| West Riding | 1 | 6½ | 10 | 47/– | — | 4 5 2 |
| **MANUFACTURING COMPANIES** | | | | | | |
| Aron Electricity Ord. | 1 | 10 | 15 | 2¾ | — | 5 9 1 |
| Assoc. Elec. Ord. | 1 | 8 | 10 | 49/6 | –1/– | 4 1 0 |
| Do. Pref. | 1 | 8 | 8 | 38/– | — | 4 4 3 |
| Babcock & Wilcox | 1 | 8 | 10 | 50/– | — | 4 0 0 |
| British Aluminium Ord. | 1 | 7½ | 10 | 50/6 | –1/– | 3 19 6 |
| British Insulated Ord. | Stock | 20 | 20 | 4 ¾ xb. | — | 4 5 3 |
| Brush Ord. | Stock | Nil | Nil | 61½ | — | — |
| Callender's | 1 | 15 | 15 | 4 ¼ | — | 3 4 0 |
| Do. 6½% Pref. | 1 | 6½ | 6½ | 30/– | — | 4 6 8 |
| Crompton Parkinson Ord. | 5/– | 12½ | 12½ | 61/3 | – ¼ | — |
| Do. 8% Pref. | 1 | 8 | 8 | 37/6 | — | 4 5 4 |
| Electric Construction | 1 | 3½ | 7 | 37/6 | — | 3 14 8 |
| Enfield Cable Ord. | 1 | 25 | 25 | 5 ¼ | — | 4 14 0 |
| English Electric | 1 | Nil | Nil | 32/6 | –6d. | — |
| Do. do. Pref. | 1 | 6½ | 6½ | 24/6 | — | 5 8 4 |
| Ericsson Tel. | 5/– | 20 | 25 | 51/3 | — | 2 8 10 |
| Ever Ready | 5/– | 35 | 45 | 32/3 | — | 6 19 7 |
| Ferranti Pref. | 1 | 7 | 7 | 27/6 | — | 5 2 10 |
| G.E.C. Pref. | 1 | 6½ | 6½ | 31/3 | — | 4 3 2 |
| Do. Ord. | 1 | 10 | 15 | 85/– | –1/– | 3 10 7 |
| Henleys | 5/– | 30 | 15 | 1 | — | 3 15 0 |
| Do. 4½% Pref. | 1 | 4½ | 4½ | 1½ | — | 4 0 0 |
| India-Rubber Pref. | 1 | 5½ | 5½ | 22/6 | — | 4 17 9 |
| Johnson & Phillips | 1 | 7½ | 10 | 45/– | — | 4 9 0 |
| Lancashire Dynamo | 1 | 10 | 20 | 3 ¼ | — | 6 1 0 |
| Siemens Ord. | 1 | 6 | 7½ | 32/6 | — | 4 12 4 |
| Telegraph Construction | £1 | Nil | 7½ | 2 ¼ | — | 2 8 5 |

* Dividends are paid free of Income Tax.

# Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

**1935**

26176. "Commutator and like brushes." O. Kasperowski. September 20th, 1935. (464679.)

28811. "Means for suppressing disturbances in ionic valves by grid control." Allmänna Svenska Elektriska Aktiebolaget. October 22nd, 1934. (464765.)

28985. "Magnetic deflecting means for cathode-ray tubes." Fernseh Akt.-Ges. October 19th, 1934. (Cognate application 23986/35.) (464637.)

29034. "Electrical resistances and their manufacture." O. Rohm. April 5th, 1935. (464688.)

29053. "Electrical switchgear." G. E. Whitehead and Whitehead's Electrical Inventions, Ltd. October 21st, 1935. (464767.)

29151. "Television and like transmission systems." I. Shoenberg. October 22nd, 1935. (464692.)

29152. "High-frequency signalling systems." E. C. Cork and J. L. Pawsey. October 22nd, 1935. (Cognate application 4719/36.) (464825.)

29193. "Modulating systems for wireless apparatus." K. Schuchter. September 12th, 1935. (464768.)

29194. "Aerial systems for wireless apparatus." K. Schuchter. September 12th, 1935. (464769.)

29198. "Electric clocks." Ferranti, Ltd., and E. Grundy. October 23rd, 1935. (464695.)

29304. "Electric switches and circuit-breakers having butt contacts." G. E. Whitehead and Whitehead's Electrical Inventions, Ltd. October 23rd, 1935. (464643.)

29312. "Thermionic valve amplifying systems for television and like transmission systems." Baird Television, Ltd., and P. W. Willans. October 23rd, 1935. (464828.)

29348. "Television." Radioakt-Ges. D. S. Loewe. October 25th, 1934. (Cognate application 29349/35.) (464831.)

29391. "Voltage-control arrangements for electric generators." Associated Electric Laboratories, Inc. November 14th, 1934. (464786.)

29405. "Modulated carrier-wave transmitters and apparatus for use therewith." Marconi's Wireless Telegraph Co., Ltd., and W. S. L. Tringham. October 24th, 1935. (Addition to 428700.) (464788.)

29406. "Aerial and aerial mounting arrangements." Marconi's Wireless Telegraph Co., Ltd., and E. H. Trump. October 24th, 1935. (464789.)

29407. "Thermionic valve circuit arrangements." Marconi's Wireless Telegraph Co., Ltd., and J. D. Brailsford. October 24th, 1935. (464790.)

29470. "Electric cables." A. W. Williams. October 25th, 1935. (464794.)

29496. "Apparatus for charging electric storage batteries." Westinghouse Brake & Signal Co., Ltd. March 21st, 1935. (464796.)

29532. "Thermostatically controlled apparatus." Standard Telephones & Cables, Ltd., and L. J. Heaton-Armstrong. October 25th, 1935. (464799.)

29533. "Alternating-current signalling systems." Standard Telephones & Cables, Ltd., and C. V. B. Neilson. October 25th, 1935. (464800.)

29535. "Terminations or joints for high-tension electric cables." Standard Telephones & Cables, Ltd., T. R. Scott, J. K. Webb and R. C. Mildner. October 25th, 1935. (Addition to 377311.) (464801.)

29781. "Electric fuses for use, particularly in electric supply apparatus." Sykes & Dyson, Ltd., P. Sykes and F. J. Griffith. October 29th, 1935. (464839.)

30811. "Electric-discharge devices." General Electric Co., Ltd., and V. J. Francis. November 7th, 1935. (464809.)

30894. "Television apparatus." J. G. Guibiansky. November 8th, 1935. (464700.)

31412. "Tubular electric incandescent lamps." A. E. F. Thomas. November 13th, 1935. (464701.)

34065. "Synchronising means in television transmitters and the like." General Electric Co., Ltd., G. W. Edwards, D. C. Espley and D. O. Walters. December 9th, 1935. (464810.)

34104. "Permanent magnets." G. A. Cheetham, C. Sykes, A. M. Armour, A. J. King and Metropolitan-Vickers Electrical Co., Ltd. December 9th, 1935. (464518.)

**1936**

209. "Elevator control systems." Westinghouse Electric & Manufacturing Co. January 2nd, 1935. (464591.)

6189. "Printing-telegraph apparatus." Nationale Telephon und-Telegraphenwerke Ges. March 2nd, 1935. (464528.)

6553. "Electrodeposition of nickel, cobalt and nickel-cobalt alloys." L. Weisberg, Inc. March 30th, 1935. (464814.)

9706. "Tele-control systems." K. G. T. Elmquist. April 1st, 1935. (464716.)

18933. "Time-correcting devices for clocks, which devices are controlled by alternating-electric current of constant frequency." H. Junghans and Junghans Akt.-Ges., Geb. July 8th, 1936. (464729.)

19879. "Valve oscillator circuit for use in superheterodyne radio receivers." Radioakt-Ges. D. S. Loewe. July 19th, 1935. (464609.)

19939. "Interconnecting circuits for telegraph repeaters." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). July 18th, 1936. (464551.)

20266. "Single-phase alternating-current motors." R. L. Archdale (Markes & Co. Ges.). July 22nd, 1936. (464730.)

20555. "Stabilisation of television amplifiers." Radioakt.-Ges. D. S. Loewe. July 25th, 1935. (464553.)

22112. "Television receiving-systems." C. Lorenz Akt.-Ges. August 23rd, 1935. (464610.)

23340. "Metal-vapour electric-discharge apparatus." Siemens-Schuckertwerke Akt.-Ges. September 30th, 1935.(464737.)

23648. "Directional radio installations." Telefunken Ges. für Drahtlose Telegraphie. August 29th, 1935. (464740.)

23661. "Cooling device for ionic valves." Allmänna Svenska Elektriska Aktiebolaget. September 2nd, 1935. (464741.)

23778. "Pump for electrically worked small refrigerating installations, more particularly for refrigerators." G. Gleissner and F. Emich. January 2nd, 1936. (464565.)

23948. "Electrically driven flyer frames." Akt.-Ges. J. J. Rieter & Cie. September 30th, 1935. (464614.)

24071. "Electrical switchgear." G. E. Whitehead and Whitehead's Electrical Inventions, Ltd. October 21st, 1935. (Divided out of 464767.) (Cognate application 4421/36.) (464566.)

24324. "Machines for the manufacture of electric lamps and the like." British Thomson-Houston Co., Ltd. September 6th, 1935. (464744.)

25124. "Driving gear with adjustable velocity ratio for altering the standing charge in coin-freed electricity meters, Landis & Gyr Akt.-Ges. September 21st, 1935. (464616.)

28500. "Electro-mechanical aggregating apparatus particularly applicable to totalisators." J. Handley, C. Suckling and R. H. Suckling. October 20th, 1936. (464622.)

30692. "Electric insulators and combined cut-out insulators and fuses." A. B. Rains (trading as E. Chapman, a firm.) November 10th, 1936. (464574.)

34091. "Permanent magnets." British Thomson-Houston Co., Ltd. December 12th, 1935. (464632.)

34098. "Rotating contact electric current rectifiers." Siemens-Schuckertwerke Akt.-Ges. December 11th, 1935. (464578.)

34262. "Casings for electricity meters, formed of compressed material, more especially artificial resin." Landis & Gyr Akt.-Ges. December 31st, 1935. (464579.)

# Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 13th:—

Dynohub. No. 575271. Class 6. Combined bicycle hubs and electric generators.—Sturmey-Archer Gears, Ltd., 177, Lenton Boulevard, Nottingham.

Goblin Beautility. No. 576137. Class 6. Washing machines. —The British Vacuum Cleaner and Engineering Co., Ltd., Parsons Green Lane, Fulham, S.W.6.

Texete. No. 575690. Class 8. Electric batteries and accumulators.—The Chloride Electrical Storage Co., Ltd., Exide Works, Clifton Junction, Manchester.

AL (lettering and design). No. 575692. Class 13. Metal goods.—The Electric Auto-Lite Co., Toledo, O., U.S.A. (British representatives, Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

## An Electrified Estate

ROCK Estate is a well-farmed holding of some 2,000 acres, five miles north of Alnwick, Northumberland. The owner, Mr. C. J. C. Bosanquet, decided to take advantage of the facilities offered by the North-Eastern Electric Supply Co. by using electricity wherever practicable, and a scheme was drawn up by the estate agent, Mr. W. MacDonald, in collaboration with the company's agricultural engineer, Mr. H. D. Phelps.

Supply is afforded to the church (in which a hand-operated organ blower has been superseded), the village hall and to every house and cottage at Rock, as well as the cottages at Rock Farm and three other farms. The lighting installations and the provision of heating plugs have been carried out, at the cost of the estate, by Mr. A. E. Leppingwell (Alnwick) and Mr. O. Hughes (Seahouses), the electrical contractors. Each set of farm buildings is having not fewer than thirty lights installed, together with plugs for portable apparatus such as turnip-cutting, clipping and shearing machines.

At three farms 18-h.p. single-phase motors drive built-in threshing machines, grinding and crushing mills, &c.; at the fourth, where in addition to similar plant there is the estate saw mill, the motor is of 30 h.p. In all about 90 h.p. of motors will be installed, displacing the heavy-oil or petrol engines and two lighting sets.

As the tenants had used only gas or oil previously, the supply company arranged for a lantern lecture at Rock by Miss A. Holm and Mr. Phelps, and on May 18th provided facilities for them to visit its headquarters at Carliol House, Newcastle-on-Tyne, where they inspected the kitchens, electric boiler house, &c. A party of 100 was conducted over Dunston power station where the foundations for a fourth 50,000-kW turbo-alternator are being laid down, and they were afterwards welcomed by Mr. V. A. H. Clements on behalf of the company. The visitors, many of whom had not been to Newcastle before, were able to remain until 10.30 p.m. in order to see the Coronation illuminations.

## Co-partnership

The May issue of *Contact*, the monthly staff journal of the London Associated Electricity Undertakings, contains an article by the Staff Controller detailing the benefits which the L.A.E.U. staff enjoy. It is mentioned that under the staff assurance scheme employés were insured for £262,215 in 1936 and the company contributed £3,481 towards the premiums payable. Further, there is a co-partnership scheme through which 1,633 employés benefited in 1936 and out of which employés pay their proportion of the premiums due under the assurance scheme. The investment of the monies received under co-partnership is taken care of by the company, as the amount due to each employé under the scheme is credited to a deposit account in his name upon which he is paid interest at the rate of 5 per cent. Employés may also deposit additional sums, not exceeding £1 per week, provided the total amount to their credit is not more than equal to one and a half years' normal salary or wage.

# New Work for Contractors

**Particulars of new works and building schemes for the use of electrical installation contractors and traders**

*Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.*

**Aberdeen.**—Houses (122), Powis estate; A. B. Gardner, 11, Broad Street. Cinema, Frederick Street, for the owners of the His Majesty's Theatre.

**Alvechurch.**—Houses (32), Redditch Road; R. H. Davis, builders, Birmingham.

**Bakewell.**—Houses (30), Great Longstone; Aylsham Housing Association.

**Batley.**—Senior Girls' school, Carlinghow; W. Chasen Ralph & Son, architects, 31a, King Street, Wigan.

**Birmingham.**—Factory, Hurst Street, for Fisher & Ludlow, Ltd., Rea Street; Tottle & Co., builders, West Bromwich.

**Blaby (LEICESTERSHIRE).**—Cinema; Cockroft Bros.

**Blackpool.**—Hotels, Tudor Place, for Blackpool Precast Stone Co., Ltd., Collins Avenue, North Shore.

**Bollington.**—Estate development, Henshall Road; H. Bamford.

**Bournemouth.**—Shops and flats, Poole Road; Collins and Greens.

**Brighouse.**—Houses (50); I. M. and H. M. Helliwell, Hipperholme.

**Bromsgrove.**—Shops, Cofton Hall estate; H. Porritt, builders, Rednal, Barnt Green.

**Buxton.**—School, Kents Bank Road, for E.C.; F. Langley, borough architect, Town Hall.

**Campbeltown.**—Houses (315), Millknowe and Catton (£160,000); Neil Ferguson, burgh surveyor, High Street, Campeltown.

**Cardiff.**—Houses (66), Ely estate (£22,000); E. Addicott & Son. Offices and clinics, Ely and Grangetown (£23,275); city engineer. Extensions to Sloper Road bus depôt (£11,075); Dawnays, Ltd.

**Cheshire.**—Schools, Bromborough, Frodsham, Sale Ashton, and Sale Moor, for County E.C.

**Chesterfield.**—Houses (37), Devonshire Avenue North; borough surveyor, 2, Gluman Gate.

**Darlington.**—Showrooms and offices, Park Lane, for E. D. Walker and Wilson, Ltd.; J. Clayton, architect, High Row Chambers.

**Denbighshire.**—School, Abergele (£18,180), for County E.C.

**Denton.**—Rebuilding the Palace Cinema; Roberts, Wood & Elder, architects, King Street, Manchester.

**Dodworth.**—Houses (140); Bambridge Bros., Ltd., builders.

**Douglas (I.O.M.).**—Offices and stores, Demesne Road; Finch Hill Motors, Ltd.

**Durham.**—Houses (76), Merro Oaks estate; H. E. Pitt, Ltd., builders, Leopold Street, Millfield, Sunderland. Houses, Shincliffe and Cassop; H. Pescod, architect, Byland Lodge, Durham.

**East Ashford.**—Houses (50), various sites; T. H. Wilde, R.D.C. surveyor, Willesborough.

**Finedon.**—Additions to factory, Summerlee Road; Gammidge and Co.

**Glasgow.**—Buildings at Bellahouston Park; Empire Exhibition Committee. Cinema, Paisley Road West; Bryden, Robertson and Boyd, architects, 147, Bath Street. Electric lamp factory, Shieldhall Road, for the British Luna Co-operative Electric Lamp Society, 95, Morrison Street; Society's architects' department. Factory and offices, 87, Colvend Street, for the Glasgow Bag Wash Laundry Services, Ltd., 145, Fielden Street. Nurses' home at the Municipal Hospital, Robroyston, Millerston; city architect.

**Glastonbury.**—Houses (20), Tor View Avenue; Tor View Estates, Ltd.

**Gloucester.**—Factory, adjoining the Gloucester and Cheltenham Airport, Staverton, for Rotol Airscrews, Ltd.

**Grays (ESSEX).**—Cinema, George Street; Frank Matcham & Co., architects, 62, Oxford Street, London, W.1.

**Hamilton.**—Store buildings, Quarryhall Terrace (£11,500); burgh surveyor.

**Hastings.**—Houses (22), near Frederick Road; Jeffrey & Wyatt, architects.

**Hipperholme.**—Houses (50), near Smith House Lane, for H. M. Helliwell; R. T. Hinchliffe & Son, builders, Odsall, Bradford.

**Inverness.**—Houses (100), South Kessock; W. Smith, architect, 52, High Street, Inverness.

**Keighley.**—Additions to works, Bradford Road; W. Whitaker & Co., Ltd.

**Kent.**—Premises for junior technical school, Bexley; county architect, Sessions House, Maidstone.

**Kettering.**—Houses (22), Weldon Road, Weldon; T. Bennett.

**Kidderminster.**—Houses (86), near Franche Road; G. S. Tomkinson, Whitville, Franche Road. Houses (47), Sion Hill; S. G. Marsh, Hobmoor Road, South Yardley, Birmingham. Houses, Wolverley and Chaddesley Corbett; W. Parkin, clerk, Central Chambers, High Street.

**Kilmarnock.**—Bank premises, the Cross (£22,000), for the Royal Bank of Scotland.

**Kinlochleven.**—Houses (20), for the Kinlochleven Village Improvement Society, Ltd.; resident architect.

**Kirkcaldy.**—Massage department at the hospital; medical officer.

**Lanark.**—Houses (134), Maddermains; J. H. Fraser Stewart, 38, High Street, Lanark.

**Liverpool.**—Two schools, West Derby Road and Bankfield Road, for E.C.

**Loughborough.**—Houses (62), Bottle Acre Lane; Fletcher Estates, Ltd.

**Middlesbrough.**—Fire station, Park Road South, for the Fire Brigade Committee; town clerk, Municipal Buildings. Alterations to business premises, Newport Crescent, for Binns, Ltd.; Gordon Durham & Co., builders, East Boldon, Co. Durham.

**Middlewich.**—Houses (48), Sutton Lane; A. Sheldon, architect, Victoria Building.

**Monifieth.**—Houses (32), Tay Street and Brook Street; C. H. Mackenzie, burgh surveyor, Municipal Offices.

**Montgomeryshire.**—School, Machynlleth, for County E.C.; E. Deacon, builder, Kington.

**Morley (YORKSHIRE).**—Houses (28), and bungalows, Hill Top, West Ardsley; borough surveyor.

**Newcastle-on-Tyne.**—Houses (54), Fawdon, for C.C.; Kirk and Dickinson, builders, New Bridge Street, Newcastle-on-Tyne. Branch library, Byker, for C.C.; city architect, 18, Cloth Market, Newcastle-on-Tyne.

**Northampton.**—Houses (166), Spencer estate; borough engineer. Cinema, Welford Road; Harris & Faulkner.

**Oadby (LEICESTERSHIRE).**—Cinema; Cockroft Bros.

**Oxford.**—Houses (342), Rose Hill and Barton estates (£150,000); B. Hastwayte, builders, Nottingham. Factory, Southam Road, for the Switchgear & Equipment Co., Banbury.

**Peterborough.**—Houses (30); G. J. Batten.

**Plymouth.**—Cinema, Union Street, for the Odeon Theatres, Ltd., Bennett's Hill, Birmingham; staff architect.

**Rainford.**—Houses (50); clerk, Council Offices.

**Redditch.**—Hotel, Jewell Street, for Mitchells & Butlers, Ltd., Cape Hill, Smethwick; C. E. M. Fillmore, architect, High Street, West Bromwich.

**St. Ives.**—Houses (57), Needingworth Road (£21,113); J. T. Walford, builder, Blackheath.

**St. Neots.**—Houses, Huntingdon Road, St. Neots, and Potton Road, Eynesbury; E. B. Parkinson, architect, 27, Newnham Road, Cambridge.

**Saddleworth.**—Houses (32), Denshaw; Dixon, Hill & Co., architects, Union Street, Oldham.

**Sheffield.**—Houses and flats, Parson Cross estate (Scheme 8); W. V. Davies, city architect.

**Shropshire.**—School, Longdon Road, Shrewsbury (£35,000), for County E.C.; W. Highley, builder, Shrewsbury.

**Smethwick.**—Additions to the municipal college, with electrical work; borough surveyor, Town Hall.

**Southall.**—Houses (222), Dane Road site; J. B. Thomson, borough surveyor.

**South Shields.**—Extensions to premises, Smithy Street, for Binns, Ltd.; Carruthers & Sons, builders, Heugh Terrace.

**Staffordshire.**—School, Leek, and technical college, Stafford, for County E.C.

**Stockport.**—Houses, Nangreave estate, Hempshaw Lane, for W. G. West, Highfield Park, Bredbury; Peter Peirce & Son, 30, St. Petersgate.

**Stokesley.**—Bus station, North Road; United Automobile Services, Ltd., Grange Road, Darlington.

**Stratford-on-Avon.**—Houses (32), Swincote estate (£12,555); G. Whateley & Sons, builders.

**Sunderland.**—Shops and offices, High Street West, for Town Tailors, Ltd.; W. & T. R. Milburn, architects, 17, Fawcett Street. Alterations to the Empire Theatre; J. W. White, builder, High Barnes Works.

**Swansea.**—Houses (33), near Ashleigh Road; D. Glyn Williams. Houses (118), Station Road, Cockett; T. & G. Spragg. Cinema, Central Hotel site, High Street; L. Morris, 52, Shaftesbury Avenue, London, W.1.

**Thurlstone.**—Houses (24), Royd Lane, Millhouse; Lunn, Heppenstall, Lunn, architects, Milnsbridge, Huddersfield.

**Tynemouth.**—Houses (248), Ridges estate; Dr. D. M. O'Herlihy, borough surveyor, 19, Howard Street, North Shields.

**Wakefield.**—Houses (22); W. Emery.

**Warwickshire.**—Council Chamber, Committee rooms, offices, &c., near Warwick Square, Warwick (£100,000), with electrical work; A. C. Bunch, county architect, County Hall.

**Watford.**—Factory, Rickmansworth Road; Saville Perfumery Co.

**Wembley.**—Municipal buildings, Forty Lane, including Council chamber, library and public hall; K. Tansley, clerk, Council offices, High Road.

**West Bromwich.**—Houses (172), Vernon Street and Hamstead Road; Wm. Cooper & Son. Works, Spon Lane; W. Adams & Sons, Ltd. Extensions to bus depôt; Parsons & Morrin, Ltd.

**West Ham.**—School for deaf (£12,988), for E.C.

**West Hartlepool.**—Houses, Longmore Street, King Street and Winter Street, for the S.S. Northumberland and Durham Real Estate Co., Ltd.; Heslop & Johnson, architects, Church Square.

**Wolverhampton.**—Houses (26), Old Heath Road; M. A. Boswell. Extension to foundry, Swan Street; John Lysaght, Ltd.

## United States Hydro-electric Projects

The New York State Power Authority, in its annual report, recommends that the St. Lawrence seaway and power development project shall be undertaken without delay to insure an adequate supply of cheap power which will be needed in the future, states the *Electrical World*. The authority declares that in another decade the State will be faced with a serious shortage unless steps are taken without delay to make available all the power potentialities of the St. Lawrence and Niagara Rivers. Failure to harness the St. Lawrence and the unused power of the Niagara River will compel production by steam plants of the equivalent of the power these two seats of hydro-electric power can provide. This will increase the cost to consumers by at least $27,000,000 a year. The emergency which the State will face if public development of the St. Lawrence and Niagara resources is further delayed is more serious than this figure indicates, the report adds.